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DEPARTMENT OF NATIONAL DEFENCE  
CANADA



OPERATIONAL RESEARCH DIVISION

DIRECTORATE OF OPERATIONAL RESEARCH (JOINT)

ORD PROJECT REPORT PR 2001/21

**OPERATIONAL RESEARCH SUPPORT TO THE  
ARMY SUSTAINABILITY EXERCISE**

BY

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NOVEMBER 2001

OTTAWA, CANADA



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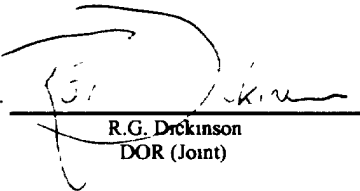
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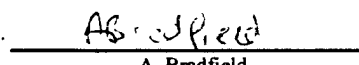
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NOVEMBER 2001

## **Abstract**

The Army Sustainability Exercise (ASX) was conducted from 2-6 April 2001 in Montebello, Quebec. The aim of the ASX was to produce a blueprint for a sustainable (costs and activity levels) Army by 2004. A cost-benefit analysis was conducted using a software package called EQUITY® to assess the value of Army units against several predetermined criteria. The EQUITY outputs were force structure options for the Regular and Reserve Forces that maximised their value based on the participants' valuations. ASX syndicates then applied the operator knowledge and expertise using these EQUITY "solutions" as starting points to generate proposals for a sustainable Army. The effectiveness of these new force structures in meeting the demands for operational assets generated by the concurrent activation of the Force Planning Scenarios was assessed using the Scenario Operational Capability Risk Assessment Model (SOCRAM). This report documents the process employed for the ASX, the data generated to support the analysis and the results obtained from the Exercise.

## **Résumé**

L'étude sur la soutenabilité de l'armée (ESA) a été réalisée du 2 au 6 avril à Montebello, au Québec. L'objectif en était de produire un schéma directeur visant à atteindre la soutenabilité des forces armées (par rapport aux coûts et à l'activité) d'ici 2004. Une analyse de rentabilité a été faite au moyen du progiciel EQUITY® pour évaluer la valeur des unités des forces armées en fonction de certains critères prédéterminés. À partir de l'évaluation des participants, EQUITY a proposé des structures qui porteraient au maximum la valeur de la Force régulière et de la Force de réserve. Ensuite, en se basant sur les « solutions » d'EQUITY, l'ESA a eu recours aux connaissances et à la compétence de l'opérateur pour élaborer des propositions axées sur une armée soutenable. La capacité de ces nouvelles structures à répondre à la demande en actif opérationnel découlant de l'activation simultanée des scénarios de planification des Forces a été évaluée à l'aide du Modèle d'analyse des risques des capacités opérationnelles fondé sur les scénarios (MARCOS). Le présent rapport présente le processus de l'ESA, les données générées pour appuyer l'analyse et les résultats de l'étude.

## Executive Summary

The Army Sustainability Exercise (ASX) was conducted from 2-6 April in Montebello, Quebec. The aim of the ASX was to produce a sustainable Army by 2004. It was realised that this would entail defining a new force structure for the Army and activity levels for its components that would reduce the current recurring annual deficit of approximately \$300M.

A model was constructed using a software package from the London School of Economics called EQUITY. The ASX participants used EQUITY to assess the value of the Army's various unit-types (mechanised infantry, armour, engineers, etc.) according to four assessment criteria:

- a. Scenarios – designed to capture the utility each unit-type or Reserve mission element in regards to the Department of National Defence's (DND) set of Force Planning Scenarios;
- b. Taskings – measures the response that each unit or mission element can provide to support the Army's tasking load;
- c. Footprint – measures the effect and impact that the unit or mission element has on the visibility of DND/CF within the country; and
- d. Mobilisation – measures the contribution the unit or mission element has on the four-stage mobilisation framework.

The Army Comptroller staff created a complementary macro-level Activity Based Costing (ABC) model. This model distinguished the five main areas where the Army's budget is expended: force structure (Person Years), individual training, collective training, capital equipment and garrison support. Using these data, fixed and variable costs were attributed to each of the unit-types so that accurate costing was available for the EQUITY model.

When combined, these two models enabled a cost-benefit analysis of the Army to be performed. The EQUITY package took as inputs the valuations of the unit-types provided by the ASX participants, the cost data from the ABC model and an "affordability point" which represents the Army's apportionment of DND's budget as outlined in Defence Plan 2001. From there, EQUITY derived an "optimal" force structure. In this instance, optimal was considered the force structure that had the greatest assessed value for a given cost (the best bang for the buck).

In reality, EQUITY does not know how to create a viable Army that is capable of meeting the range of tasks that the Army could be assigned. Consequently, the ASX participants were formed into syndicates and each was asked to modify the EQUITY outputs to develop a force structure that could potentially be implemented by 2004 and would meet affordability, sustainability and operational requirements. These five syndicate solutions for the Regular Force Army (which do not include Reserve mission elements), shown in the Table ES-I, consisted of the number of unit sized entities that would exist for each unit-type. These were presented to the Chief of the Land Staff and other guests on the final day of the ASX. Note that some syndicates submitted two solution sets, generally a two-brigade and a three-brigade option.

**TABLE ES-I**  
**SYNDICATE SOLUTIONS FOR THE REGULAR FORCE**

	Number of Units								
	Present Army	Syn 1a	Syn 1b	Syn 2a	Syn 2b	Syn 3	Syn 4	Syn 5a	Syn 5b
Mech Infantry Bn	6	6	5	6	8	6	4	8	4
Light Infantry Bn	3	0	0	0	0	2	4	0	5
Armoured Regt	3	2	3	2	3	2	1	2	2
Artillery Regt	3	1	1	2	3	2	1	1	1
LLAD Bty	1	1	1	2	0	1	0	0	0
VSHORAD Bty	1	1	1	2	1	1	0	1	0
Field Engineer Regt	3	2	3	2	3	3	3	2	3
Engineer Sp Regt	1	1	1	0	1	1	1	1	1
CS Service Bn	3	2	3	2	3	3	3	2	3
Command Sp Bn	3	2	3	2	3	3	3	2	3
GS Service Bn*	3	3	3	3	3	3	3	3	3
EW Squadron*	1	1	1	1	1	1	1	1	1
MP Platoon*	3	3	3	3	3	3	3	3	3
* For simplicity, these units were "parked" and not assessed. Current inventories were assumed.									
<b>Value Score</b>	<b>953</b>	<b>713</b>	<b>777</b>	<b>700</b>	<b>798</b>	<b>888</b>	<b>791</b>	<b>676</b>	<b>821</b>
<b>Cost (\$B)</b>	<b>1.54</b>	<b>1.14</b>	<b>1.22</b>	<b>1.19</b>	<b>1.45</b>	<b>1.38</b>	<b>1.15</b>	<b>1.18</b>	<b>1.21</b>

A number of themes were common to most syndicates:

- a. tiered readiness has the potential to generate a significant savings for the Army;
- b. the differences in the force generation structure and the force employment structure need to be reconciled;

- c. there is a preference for Mechanised Infantry over Light Infantry and generally all other trades;
- d. suggestions were given for specialised tasks for the Reserves (e.g. CIMIC, PSYOPS) to increase their value; and
- e. despite the potential political implications and regional sensitivities, some syndicates indicated a preference for a two Brigade Group option.

Due to difficulties with the assessment process, the Reserve Force was evaluated independently from the Regular Force. The ASX participants were then asked to develop bridging factors to compare the value of the Reserve mission elements with their Regular Force counterparts. The two separate models were then merged to permit a "Total-Force" evaluation. The EQUITY solution to the Total-Force Army is presented in the Table ES-II. Note that some of the quantities for the Regular Force units do not match those presented above. This is because EQUITY completely recalculates the "optimal" force structure for this case.

**TABLE ES-II**  
**PRESENT ARMY FORCE STRUCTURE AND THE "OPTIMAL" EQUITY**  
**SOLUTION FOR THE REGULAR AND RESERVE FORCES**

<b>Unit / Mission Element</b>	<b>Number of Units</b>	
	<b>Present Army</b>	<b>EQUITY Solution</b>
Mech Infantry Bn	6	4
Light Infantry Bn	3	3
Res Infantry Msn Elm	62	62
Armoured Regt	3	2
Res Armd Msn Elm	15	15
Res Reconnaissance Msn Elm	9	9
Artillery Regt	3	1
Res Artillery Msn Elm	21	21
LLAD Bty	1	1
VSHORAD Bty	1	2
Res VSHORAD Bty	4	5
Field Engineer Regt	3	3
Res Field Engineer Msn Elm	12	12
Engineer Sp Regt	1	1
CS Service Bn	3	3
Res Service Bn Msn Elm	22	22
Command Support Bn	3	3
GS Service Bn*	3	3
Electronic Warfare Squadron*	1	1
Military Police Platoon*	3	3

\* For simplicity, these units were "parked" and not assessed. Current inventories were assumed.

During the post-analysis, these force structures were used as inventory asset inputs into the Scenario Operational Capability Risk Assessment Model (SOCRAM). SOCRAM was then used to investigate the operational impacts (risks) of moving to one of these new Army force structures. Based on the assessed demands for each of the Force Planning Scenario variants, SOCRAM uses a Monte Carlo technique to simulate concurrent activation of the variants and hence an aggregate requirement for operational assets.

While the time constraints of the ASX did not permit the definition of a single proposed force structure for the Army, significant progress was made toward that end. Many of the observations augur for a programmed series of restructuring exercises rather than the current ad hoc approach. A phased approach would allow greater fidelity and promote dialogue and buy-in.

## Table of Contents

<b>Abstract</b>	<b>i</b>
<b>Executive Summary</b>	<b>iii</b>
<b>Table of Contents</b>	<b>vii</b>
<b>List of Figures</b>	<b>ix</b>
<b>List of Tables</b>	<b>x</b>
<b>List of Abbreviations</b>	<b>xi</b>

<b>OPERATIONAL RESEARCH SUPPORT TO THE ARMY SUSTAINABILITY EXERCISE</b>	<b>1</b>
<b>1. Introduction</b>	<b>1</b>
1.1 Background	1
1.2 Aim	3
1.3 Scope	3
<b>2. The Army Sustainability Exercise Model</b>	<b>4</b>
2.1 Sustaining Agenda	4
2.2 Change Agenda	7
2.3 Constraints	8
<b>3. Operational Research Tools for the Army Sustainability Exercise</b>	<b>10</b>
3.1 Force Planning Scenarios	10
3.2 The Army Costing Model	11
3.3 EQUITY <sup>®</sup>	12
3.4 Analytic Hierarchy Process	15
3.5 Scenario Operational Capability Risk Assessment Model	17
<b>4. Army Sustainability Exercise Preparations</b>	<b>21</b>
4.1 Initial Explorations / Preparations for the Working Group Trial	21
4.2 The ASX Working Group Trial	26
4.2.1 Cost Model Examination	26
4.2.2 EQUITY Testing	26
4.2.3 SOCRAM Assessment	33
<b>5. Conduct of the Army Sustainability Exercise</b>	<b>34</b>
5.1 Day 1	34
5.2 Day 2	37
5.3 Day 3	39
5.3.1 Initial Results	39
5.3.2 Redefining the Methodology for the Regular Force	41
5.4 Day 4	43
5.4.1 Regular Force Re-Valuation	43

5.4.2	Redefining the Methodology for the Reserve Force	47
5.5	Day 5	51
<b>6.</b>	<b>Results</b>	<b>53</b>
6.1	Syndicate Solutions	53
6.1.1	Syndicate 1	53
6.1.2	Syndicate 2	54
6.1.3	Syndicate 3	54
6.1.4	Syndicate 4	54
6.1.5	Syndicate 5	55
6.1.6	Summary	55
6.2	Common Themes	58
6.3	Post-ASX Analysis	58
6.3.1	EQUITY Results	58
6.3.2	SOCRAM Results	61
<b>7.</b>	<b>Conclusions</b>	<b>67</b>
7.1	Process	67
7.2	The Way Ahead	70
<b>8.</b>	<b>References</b>	<b>71</b>
<b>Annex A - Introductory Presentations given at the Army Sustainability Exercise A-1</b>		
Appendix 1 – Army Sustainability Exercise		
Appendix 2 – ASX Performance Report Presentation		
Appendix 3 – The Tasks and Resources Report		
Appendix 4 – Le rapport de développement		
Appendix 5 – Future Army Conceptual Framework		
Appendix 6 – The ASX Model		
Appendix 7 – Creating a Managed-Readiness System		
Appendix 8 – ASX Costing Model		
<b>Annex B - Army Sustainability Exercise Participants and their Affiliations</b>		<b>B-1</b>
<b>Annex C - Force Planning Scenario Demands</b>		<b>C-1</b>
<b>Annex D - Army Sustainability Exercise Data Forms</b>		<b>D-1</b>
<b>Annex E - Complete EQUITY Results</b>		<b>E-1</b>
<b>Annex F - Syndicate Presentations</b>		<b>F-1</b>
Appendix 1 – Affordable Army Structure Options – Syndicate 1 Presentation		
Appendix 2 – ASX Presentation – 2 Syndicate “Mid-Point Option”		
Appendix 3 – Syndicate 3 Presentation		
Appendix 4 – Syndicate 4 – The Affordable Army		
Appendix 5 – Syndicate 5 – Optimising About Point M		
<b>Annex G – Guidelines for Valuing Portfolio Elements Against Scenarios</b>		<b>G-1</b>

## List of Figures

Figure 1 – Mapping of the PRAS' Capability Programs and the Army's business plan.	5
Figure 2 – Modified PRAS Framework.	6
Figure 3 – Final PRAS Army model.	7
Figure 4 – Spectrum of Conflict for the Force Planning Scenarios.	11
Figure 5 – Sample EQUITY model.	14
Figure 6 – Sample EQUITY Value vs. Cost plot.	14
Figure 7 – Construct for unit substitutability in SOCRAM.	19
Figure 8 – The ASX EQUITY Model.	24
Figure 9 – ASX WG EQUITY Solution.	32
Figure 10 – Initial EQUITY results. The items in green (to the left of the thick line for each capability area) denote the affordable EQUITY solution.	40
Figure 11 – EQUITY Force Structure for Regular Force Units.	44
Figure 12 – Value vs. Cost for Regular Force Units (initial results presented at the ASX).	45
Figure 13 – Value vs. Cost for Regular Force Units (corrected cost data created after the ASX).	47
Figure 14 – EQUITY Force Structure for Reserve Force Units.	49
Figure 15 – Value vs. Cost for Reserve Force Units (corrected cost data).	50
Figure 16 – EQUITY Force Structure for Regular and Reserve Force Units.	52
Figure 17 – Value vs. Cost for Regular and Reserve Force Units (corrected cost data).	52
Figure 18 – Value vs. Cost for Regular Force Units (including the Army Transformation Working Group's "Option C").	57
Figure 19 – Same as Figure 18, but zoomed in to relevant areas.	57
Figure 20 – Systemic risk and consequence of failure for each of the syndicate's force structures with the primary risk drivers.	64
Figure 21 – Trade-offs between high costs and values and systemic risk and consequence of failure.	65

## List of Tables

Table ES-I Syndicate Solutions for the Regular Force _____	iv
Table ES-II Present Army Force Structure and the “Optimal” EQUITY Solution for the Regular and Reserve Forces _____	v
Table I Types of Army Expenditures by Capability Area [6] _____	12
Table II The Pairwise Comparison Scale [13] _____	16
Table III EQUITY Capability Areas _____	23
Table IV ASX Working Group Criteria Weightings _____	27
Table V ASX WG Scenario Consequence Weighting _____	28
Table VI Value Guidelines for the Taskings Criterion _____	29
Table VII Value Guidelines for the Footprint Criterion _____	29
Table VIII Value Guidelines for the Mobilisation Criterion _____	30
Table IX ASX Participants Criteria Weighting _____	36
Table X ASX Participants Scenario Consequence Weighting _____	38
Table XI ASX Participants’ Criteria Weightings _____	39
Table XII Force Planning Scenario weightings in terms of Consequence of Failure and Likelihood of Occurrence _____	43
Table XIII EQUITY Solutions for the Regular Force _____	46
Table XIV Regular and Reserve Force Establishment Sizes _____	48
Table XV Reserve Bridging Scores _____	50
Table XVI Syndicate Solutions for the Regular Force _____	56
Table XVII Baseline and Perturbed Weights used in the Sensitivity Analysis _____	59
Table XVIII Sensitivity Analysis for Regular and Reserve Force Units _____	60
Table XIX Consequence of Failure, Individual and Systemic Risks for ASX Syndicate Force Structures _____	62
Table XX Sample "Low Risk" Army Force Structure _____	66

## List of Abbreviations

A/CLS	Assistant Chief of the Land Staff
ABC	Activity-Based Costing
AD	Air Defence
AHP	Analytic Hierarchy Process
Arty	Artillery
ASX	Army Sustainability Exercise
ASX WG	Army Sustainability Exercise Working Group
ATOF	Army Training and Operations Framework
ATWG	Army Transformation Working Group
Bn	Battalion
Bty	Battery
C2	Command and Control
Capt	Captain
Cbt	Combat
CF	Canadian Forces
CFRETS	Canadian Forces Recruiting Education and Training System
Ch	Chapter
CIMIC	Civil Military Co-operation
CLS	Chief of the Land Staff
CMTC	Canadian Military Training Centre
Col	Colonel
Comd	Command
Coy	Company
Cpl	Corporal
CS	Close Support
DART	Disaster Assistance Response Team
DDA	Director Defence Analysis
DGSP	Director General Strategic Planning
DLSP	Director Land Strategic Planning
DND	Department of National Defence
DOR(J&L)	Director Operational Research (Joint & Land)
DP	Developmental Period
DP01	Defence Plan 2001
DPG 2001	Defence Planning Guidance 2001
DSC	Director Strategic Change
DSPU	Defence Services Program Update
Engr	Engineer
EW	Electronic Warfare
FPS	Force Planning Scenarios
GS	General Support
HiR	High Readiness
Inf	Infantry
Intl	International

JSG	Joint Support Group
LCol	Lieutenant-Colonel
LFAA	Land Force Atlantic Area
LFC	Land Force Command
LFCA	Land Force Central Area
LFRR	Land Force Reserve Restructure
LFSDG	Land Force Strategic Direction and Guidance
LFWA	Land Force Western Area
LLAD	Low-Level Air Defence
Lt	Light
Maj	Major
Majaid	Major Air Disaster
MAUT	Multi-Attribute Utility Theory
MCF	Main Contingency Force
Mech	Mechanised
MGen	Major-General
Mil	Military
MP	Military Police
Msn Elm	Mission Element
NDHQ	National Defence Headquarters
NP	National Procurement
O&M	Operations and Maintenance
Ops	Operations
OR	Operational Research
ORD	Operational Research Division
Pl	Platoon
PMF	Performance Measurement Framework
PRAS	Planning, Reporting and Accountability Structure
PSO	Peace Support Operations
PSYOPS	Psychological Operations
PY	Person Year
Recce	Reconnaissance
Reg	Regular
Regt	Regiment
Res	Reserve
SOCRAM	Scenario Operational Capability Risk Assessment Model
SORD	Strategic Operations and Resource Directive
SORP	Strategic Operations and Resource Plan
Sp	Support
StdR	Standard Readiness
Surv	Surveillance
Svc	Service
Syn	Syndicate
TO&E	Table of Operations and Equipment
UN	United Nations
VSHORAD	Very Short Range Air Defence

# **OPERATIONAL RESEARCH SUPPORT TO THE ARMY SUSTAINABILITY EXERCISE**

## **1. INTRODUCTION**

### **1.1 BACKGROUND**

1. In September 2000, the leadership of the Army embarked upon a strategic planning campaign with the objective of renewing the Army strategy as expressed in Land Force Strategic Direction and Guidance (LFSDG) [1]. This intent has been underlined in the Army's key business planning document, the Land Forces Strategic Operations and Resource Plan 2001-2004 (SORP) [2] which directed the Land Staff to develop a blueprint for the Army of Tomorrow and to conduct a zero-based Army resource review by June 2001.

2. To that end, the Army has launched a number of strategic initiatives (e.g. Army Transformation, Army Training and Operations Framework, Land Forces Reserve Restructure, Mobilisation Planning, Canadian Manoeuvre Training Centre, etc.) to better align the Army's program with the Defence Objectives and the Change Objectives described in the Defence Planning Guidance 2001 (DPG 2001) [3] and the Departmental strategic vision outlined in Strategy 2020 [4]. In Strategic Operations and Resource Direction 2002 (SORD 2002) [5], the Commander's Vision asserts that "the Army will generate, employ and sustain strategically relevant and tactically decisive medium-weight forces. Using progressive doctrine, realistic training and leading-edge technologies, the Army will be a knowledge-based and command-centric institution capable of continuous adaptation and task tailoring across the spectrum of conflict."<sup>1</sup>

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<sup>1</sup> 7000-1 (CLS) "Land Forces Command Strategic Operations and Resource Direction 2002", Chief of the Land Staff, 29 June 2001, Chapter 1, p. 3.

3. The aim of the Army Sustainability Exercise (ASX) was “to produce a sustainable Army by 2004”[6]. This timeframe does not extend to the traditional definition of the “Army of Tomorrow” [5]. The ASX was clearly intended to address the Army’s immediate requirements of affordability and sustainability, while remaining cognisant of the realities of the Army of Tomorrow and the Future Army. Essentially, it was deemed critical that the Army not sacrifice capabilities and effectiveness in the long term in order to achieve a balanced budget in the next few years.

4. The ASX was proposed to satisfy several objectives:

a. Re-balancing.

- (1) In order to achieve the aims of affordability and sustainability, an optimum mix of force structure and activities, obtainable within allocated resource levels, was to be identified. In other words, “what the Army looks like” and “what it does” needed to be brought in line with the known funding the Army will receive in the coming years as described in DPG 2001 [3].
- (2) In addition to the need to meet the requirements of the Canadian Forces (CF) Sustaining and Change agendas [3], “balance” was also to be obtained across the following dimensions:
  - (a) field force versus garrison support, training, Command and Control (C2) and corporate responsibilities;
  - (b) the ability to meet Peace Support Operational (PSO) requirements versus Main Contingency Force (MCF) requirements (the balance between the most probable and the most dangerous contingencies);
  - (c) Regular Force and full-time Reserves versus part-time Reserves and Civilians;
  - (d) capital versus labour; and
  - (e) Land Force areas.

- b. Assess Shortfalls. Based on an appreciation that the present structure and required activity levels are not sustainable within present resource levels, the ASX was to facilitate the identification of those shortfalls and the resources necessary to achieve sustainability.
- c. Achievability. All solutions to the Army's sustainability problem that were developed at the ASX were to be achievable by the 2004 timeframe. Options were to carry with them requirements to move from the status quo to the balanced posture of 2004. Undoubtedly, this movement would be hindered by many constraints that must be overcome, e.g. current operations and commitments, political will, Army culture, etc. As part of the ASX, the participants were to identify the principal constraints and the best manner to manage those impediments.

## 1.2 AIM

5. The aim of this project report is to outline the operational research (OR) support given to the Army during the preparatory, execution and post-analysis phases of the Army Sustainability Exercise held in Montebello, QC from 2-6 April 2001.

## 1.3 SCOPE

6. This project report documents the ASX process from its initial conception through execution and the subsequent data analysis. It details the key steps taken to develop the methodology used during the ASX, include the primary results and, hopefully serve to inform the senior leadership of the Army. Equally important, the lessons learned by both the Army and the OR scientists in preparing and supporting the event will also be documented.

7. For completeness, a brief discussion of the analytical tools used during the ASX will be included. However, more detailed descriptions of the analytical models will be left to the associated reference material.

## **2. THE ARMY SUSTAINABILITY EXERCISE MODEL**

8. A model was developed to incorporate the aspects of the CF sustaining and change agendas pertinent to the Army. This was built as a joint effort with staff from the Directorate of Land Strategic Planning (DLSP) and the Operational Research Division (ORD). In particular, Lieutenant-Colonel R. Gunn's, DLSP 4, experience was invaluable in the identification of the key drivers.

9. As indicated in the ASX Planning Directive [6], the constructs of the Sustaining and Change agendas were to be the core values around which any potential Army solution must be based. Still, the ASX dealt primarily with the sustain issue within the Army of Today. However, this problem had to be addressed with a view to the realities of the Army of Tomorrow and the Future Army.

### **2.1 SUSTAINING AGENDA**

10. Within the Department, the definition of the Sustaining Agenda is described in the Planning, Reporting, and Accountability Structure (PRAS) [7] as the five Capability Programs. The PRAS is a Treasury Board mandated document that describes the Department of National Defence's (DND) mission, vision and goals, as well as defining accountable managers and performance measurement. The Capability Programs in the PRAS have roughly comparable elements in the present Army Business Planning Capability Structure.

- a. Command & Control. The PRAS describes this capability as encompassing the ability to exercise effective command and control of the Canadian Forces (CF). From an Army perspective, this capability is predominantly resident in the Land Force Command (LFC) Headquarters in Ottawa, the area headquarters (Land Force Atlantic Area (LFAA), Land Force Quebec Area (LFQA), Land Force Central Area (LFCA) and Land Force Western Area (LFWA)) and the Reserve Brigade Headquarters.

- b. Conduct Operations. This capability deals with the ability to employ the range of military capabilities required to achieve assigned missions, when and where directed. The equivalent Army capability is primarily resident in the collective training that the Army does for both the Regular Force and the Reserve Mission Elements in order to be operationally ready when called upon by the Government of Canada.
- c. Sustain Forces. This area covers the repair and maintenance of equipment, the sheltering and sustainment of personnel and the production of the infrastructure and capabilities necessary to support military operations. The Army equivalent is Garrison Support.
- d. Generate Forces. This element covers the recruiting and training of personnel and the process for the acquisition of equipment. Within the Army, this capability is found in both the individual training portions of Operational Forces and the equipment portion of the Army Strategic Programs.
- e. Corporate Policy & Strategy. The PRAS sees this area as being almost exclusively provided by domestic service providers. The limited Army participation in this area is covered in the Mandated Programs of the Army business plan.

11. Represented schematically, this model of the Army’s PRAS capabilities is shown in Figure 1.

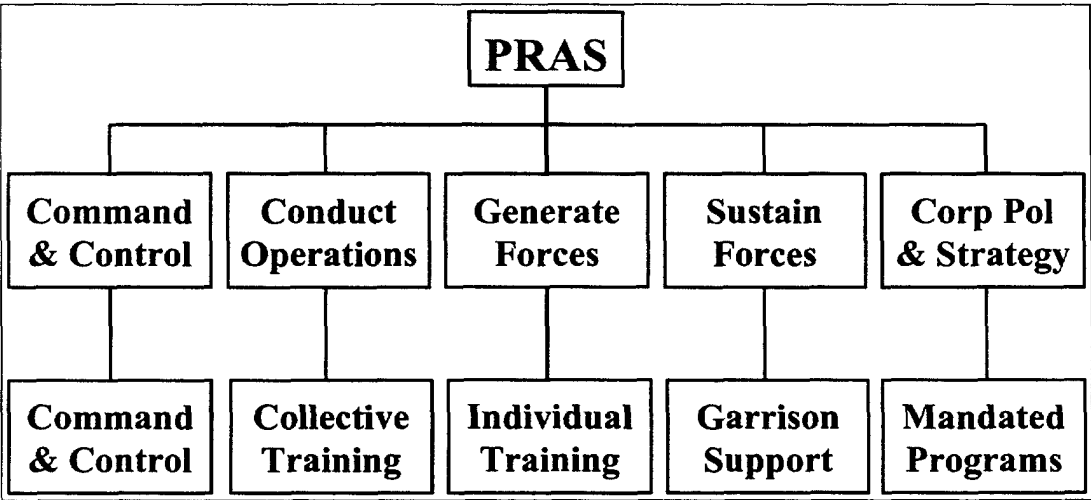


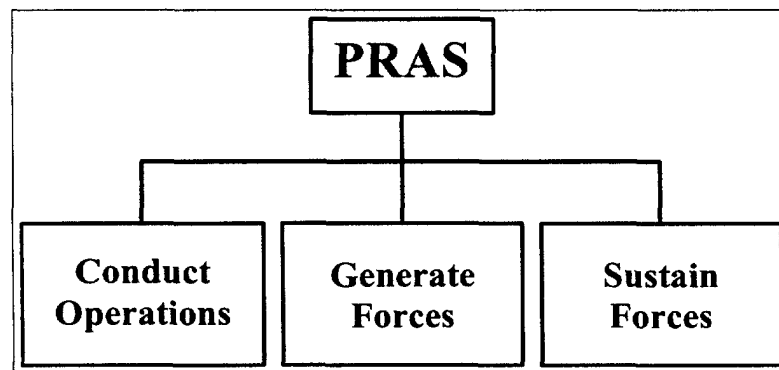
Figure 1 – Mapping of the PRAS’ Capability Programs and the Army’s business plan.

12. However, during the planning phases of the ASX, it was decided that it would be desirable to simplify the model, thereby potentially reducing the amount of data gathering required. Thus several of the PRAS capability areas were “parked” and the attention of the ASX participants was focussed on those remaining.

13. When compared to the other capability areas, C2 is a relatively small portion of the Army’s budget. Also, any changes in the Army’s force structure suggested by the ASX were not likely to have a significant effect on the C2 requirements in the timeframe in question—the same Land Force Command, Area and Reserve headquarters would most likely remain intact. Hence it was decided that the costs associated with C2 would be parked. These costs would remain a constant within the Army costing model and the “value” of these headquarters would not be assessed.

14. Also, the Army is not a “Corporate” entity. The Army does not choose which of the mandated programs it initiates, nor the degree of its participation. Since the Army has very little control over the monies that are spent in the Corporate Policy and Strategy capability area, it too was parked.

15. This led to a revised Army model shown in Figure 2.



**Figure 2 – Modified PRAS Framework.**

16. Upon reflection, it was decided that within the Army, the three entities, Conduct Operations, Generate Forces and Sustain Forces are not completely independent from one another. At the most fundamental level, force generation demands are subordinate to force employment requirements. The operational tempo determines the amount of force generation that is required and informs the basing and support requirements for the units required to train to a higher readiness level so that they are deployable.

17. Moreover, the level of force generation and hence the amount of individual training required, influence the basing requirements for the various schools. So, a further revised Army model, Figure 3, was developed. The arrows in this Figure indicate that the requirements for the subordinate entities are responses to the requirements and demands of the superior ones.

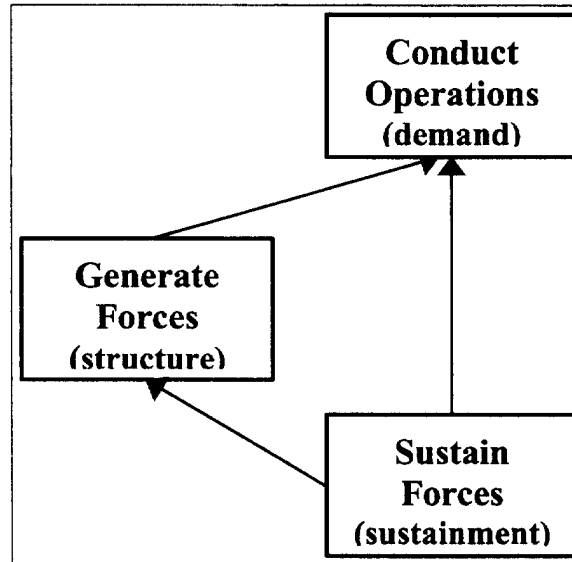


Figure 3 – Final PRAS Army model.

18. This was the model of the Army that was used to determine the valuation methodology for the Sustaining Agenda at the ASX.

## 2.2 CHANGE AGENDA

19. The ASX was conducted as part of a larger strategic planning initiative designed to refocus the Army strategy and bring greater congruence with the Departmental strategy as detailed in Strategy 2020. However, with the breadth of on-going work both within the Army (e.g. Army Transformation, Army Training and Operations Framework (ATOF), etc.) and externally (e.g. Defence Services Program Update (DSPU), etc.) it was decided that it was premature to focus on the long-term ramifications of the Change Agenda. While these concepts were not directly incorporated into the models of the Army that were used at the ASX, the participants remained mindful of the realities of the future direction of the Army as laid out in LFSDG 2001 [1] and SORD 2001 [2].

## 2.3 CONSTRAINTS

20. There were several constraints that had to be considered in the determination of a more optimal Army structure, and the types and rates of activities that the Army can undertake. These constraints served not only to limit the possible solutions, but also to guide the participants thinking towards reasonable and achievable solutions.

a. Resources.

- (1) The resources applied to the Army program are finite and are specified in the annual Defence Plan. These include not only the Army operating budget, but also apportioned accounts covering National Procurement (NP), military pay and strategic capital purchases. Portions of other Level 1 accounts expended indirectly to support Army activities also had to be included in the costing model.
- (2) From the onset of the preparations for the ASX, it was apparent that a detailed (expanded) understanding of resource consumption was required. The Army program expends resources in two fashions. Firstly, there are those resources consumed by virtue of a structure existing. These are predominantly fixed costs. Secondly, there are those resources consumed by activities. These costs are generally variable and are dependent upon the number of personnel or units and the number and types of activities. It was realised that adjustment of the resources applied to those structures and activities would shape the option set. The costing model that was developed by the Army Comptroller reflected this and is discussed in greater detail below.

- b. Army of Today. The Army of Today (force structure, activity levels, readiness levels, funding levels, etc.) provides the start point from which the Army of Tomorrow will evolve. Therefore, the formulation of alternative solutions began with an investigation of the utility of the units found in the current Army structure.
- c. Ability to Change. By its very nature, the Army is a conservative organisation that is somewhat resistant to change. The “Army

Culture” limits the distance from the present structure that can be achieved within the timeframe under consideration. This places considerable importance on process. From the onset, the need to “institutionalise” change was noted.

### **3. OPERATIONAL RESEARCH TOOLS FOR THE ARMY SUSTAINABILITY EXERCISE**

21. Several decision support and strategic planning tools were used during the ASX to discipline the thought processes (and thus the plenary discussions of the participants), to gather information and display results, and to provide the syndicates with data they would need to perform their evaluations. Brief descriptions of these tools are given below.

#### **3.1 FORCE PLANNING SCENARIOS**

22. The Force Planning Scenarios (FPS) [8] are an integral part of the capability-based planning process that has recently been established in DND/CF. The impetus for creating them was provided by the 1994 review of defence planning practices conducted by the Office of the Auditor General. This report concluded that there was inadequate linkage between capability planning and defence policy. The Director General Strategic Planning (DGSP) was tasked with resolving this problem and, starting in 1997, DGSP staff began the process of creating a set of FPS. Eventually, eleven FPS were created and, while they are now in a workable form, they continue to evolve. Full descriptions of the current set of scenarios were released for distribution throughout DND/CF in July 2000.

23. The FPS are intended to cover the entire spectrum of activities in which the CF is likely to be involved in the near future. As such they include combat operations at one extreme and operations other than war, e.g. search and rescue, disaster relief and peacekeeping, at the other extreme. This is depicted graphically in Figure 4. The scenarios serve to provide a contextual backdrop to force development.

24. The CF response to most of the situations described in the FPS is discretionary. To capture the scope of possible CF responses, a number of variants have been defined for each scenario. Each variant typically identifies a CF force package that would be activated or deployed in response to the scenario.

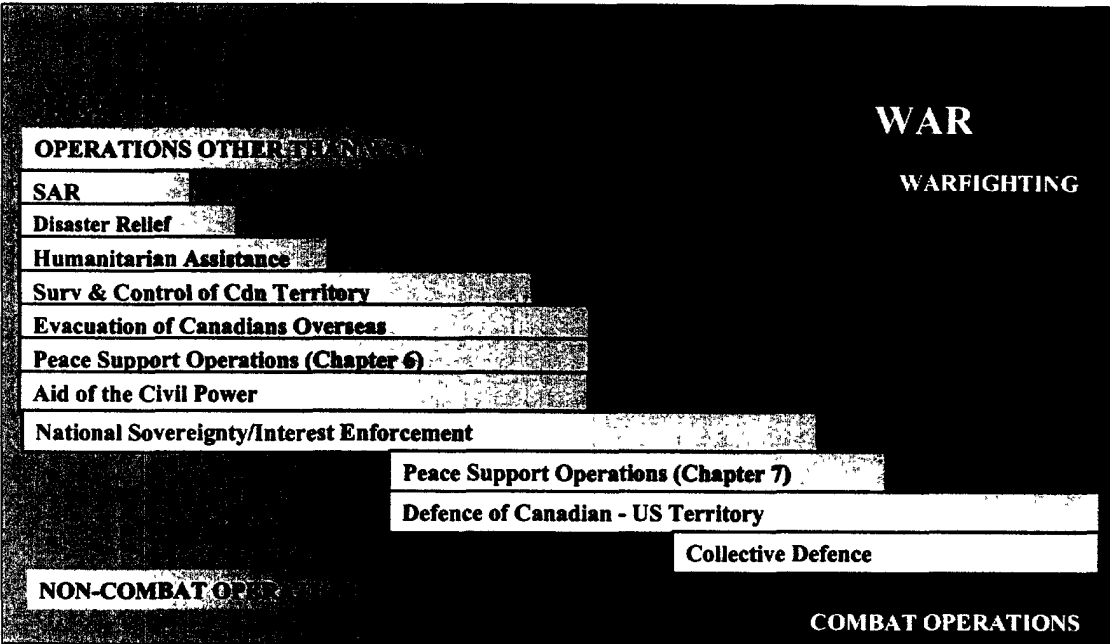


Figure 4 – Spectrum of Conflict for the Force Planning Scenarios.

25. The FPS were used during the ASX to focus discussion and were integrated into both the EQUITY cost-benefit model (§3.3) and SOCRAM, the Scenario Operational Capability Risk Assessment Model (§3.5). In particular, they served as a common departure point and contextual setting in which comparative assessments of value or benefit could be made (one of the criteria in the EQUITY model) and demand for operational assets (SOCRAM) could be determined.

3.2 THE ARMY COSTING MODEL

26. A comprehensive model describing the Army’s annual expenditures was built by the staff in the Army Comptroller’s cell. The five Capability Areas defined in the PRAS were mapped to the Army’s Business Planning Capability Structure. The initial structure was shown previously in Figure 1.

27. As indicated above, the costs associated with C2 and the mandated corporate programs were either small compared to the whole or were beyond the purview of the Army decision-making process and were parked. Additionally, the costs associated with the support to non-Army units were not considered.

28. For the three remaining Capability Areas, the approach taken was a global or macro-level view based on generic operational elements, be they Regular or Reserve

Force and both variable and fixed costs were considered. The costs associated with each of the Capability Areas are shown in Table I.

**TABLE I**  
**TYPES OF ARMY EXPENDITURES BY CAPABILITY AREA [6]**

<b>Capability Area</b>	<b>Applicable Costs</b>
Conduct Operations	• Force Structure (Person Years (PYs) – both Regular and Reserve Forces)
	• Collective Training (NP + activities)
	• Capital Equipment (Depreciated)
	• Individual Training
Generate Forces	• Garrison Support
	• Individual Training (schools, instructors, overhead, garrison support, etc.)
Sustain Forces	• Infrastructure
	• PYs
	• Operations and Maintenance (O&M)

29. The initial version of the Activity-Based Costing (ABC) model was completed just prior to the ASX. However, the model underwent multiple refinements throughout the exercise as the participants were exposed to the details and were given the opportunity to review and comment on the costs attributed to the various elements. The suggestions made by the participants provided the opportunity for the Comptroller staff to refine the model and better capture the true costs of the Army. While this ABC model remains a work in progress, it is felt that the costing model is a fairly accurate representation of the fiscal reality of the Army's activities. This in and of itself is a major step forward for the Army business planning process.

30. For additional detail on the Army's costing model, refer to Appendix 8 of Annex A.

### 3.3 EQUITY<sup>®</sup>

31. The primary aim of the ASX was to design a force structure for the Army, along with its corresponding activity levels, that would be sustainable in the long-term. In order to achieve that objective, it was necessary to develop a methodology for capability portfolio analysis for the Army. This was accomplished through the application of multi-attribute utility theory (MAUT) [9]. MAUT is the sub-branch of

decision analysis that assesses the “utility” or value of a set of items using multiple, and often competing, objectives.

32. A software tool called EQUITY<sup>®</sup> that was developed by the London School of Economics implements a MAUT model. “It’s main use lies in resource allocation problems where a limited budget needs to be applied to different areas or projects in a business and where the business wants to maximise the value of these to various business goals”<sup>2</sup>. An EQUITY analysis considers value for cost options. It assists decision-makers to optimally assign resources across multiple areas such that maximum benefit is achieved.

33. To determine which areas will provide this “maximum benefit”, EQUITY uses a weighted sum to find the value or utility of each option. For example, if  $v_{ij}$  is the value of option  $i$  on criterion  $j$  and  $w_j$  is the weight of criterion  $j$ , then the overall value,  $V_i$ , of option  $i$  summed over all the criteria is given in reference [10] as:

$$V_i = \sum_j w_j v_{ij}$$

34. The use of this simple form of aggregation has required the authors to make the assumption that the assessment criteria, which are described in §4.1, are independent of one another.

35. An EQUITY model consists of a set of capability areas or areas of competency. In turn, each of these areas has a set of levels of effort. Having multiple levels of effort for each capability area allows the decision-maker to explore the impacts of increasing or decreasing the resources allocated to that area.

36. A simple EQUITY model is shown in Figure 5. This example has three capability areas, “Distribution”, “Promotion” and “Advertising”, each with a number of levels of effort extending from lowest to highest cost from left to right. Once the value of each of the capability areas has been assessed in terms of the criteria deemed to be important, the optimal solutions (those that provide the maximum benefit for a given cost) can be determined. These solutions are said to be on the *efficiency frontier*, or simply the frontier of the Value vs. Cost plot, Figure 6. The frontier

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<sup>2</sup> Bond, S.A., EQUITY for Windows, Version 1, Enterprise LSE, 1995, §1.1.

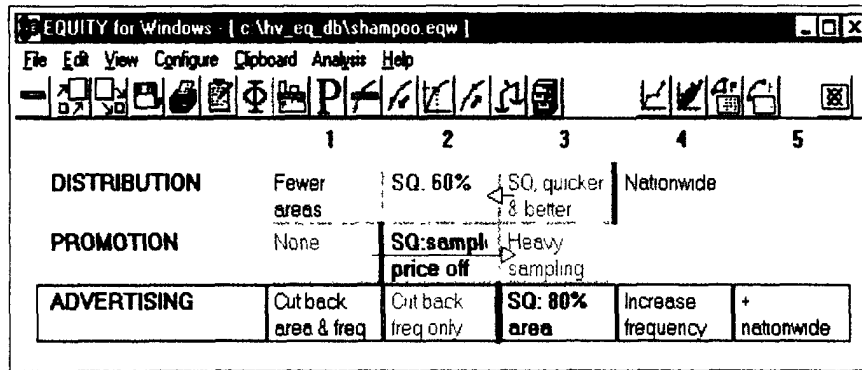


Figure 5 – Sample EQUITY model.

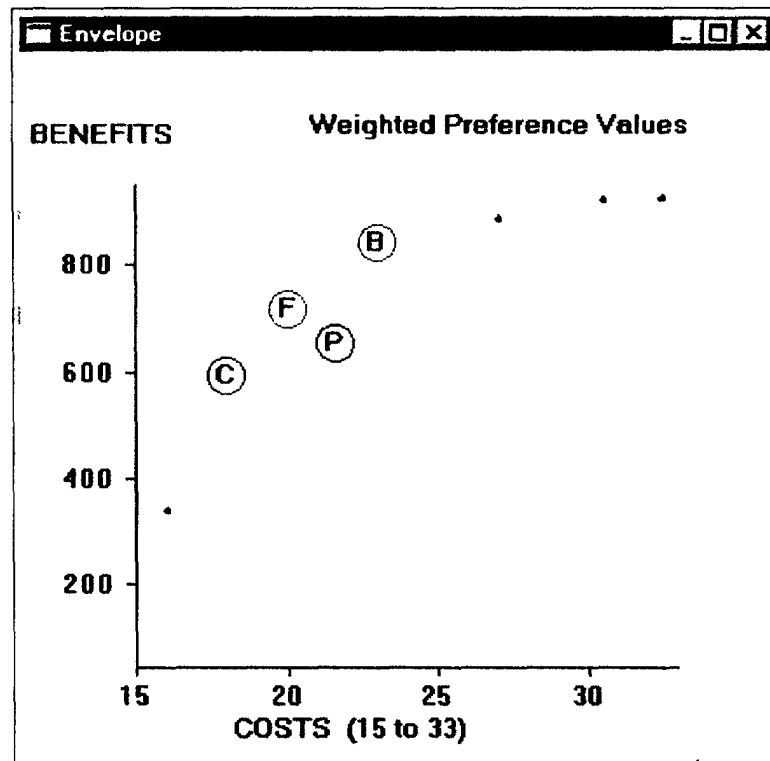


Figure 6 – Sample EQUITY Value vs. Cost plot.

solutions in this Figure are represented by the black dots that appear on top of the green shaded area; sub-optimal solutions comprise the remainder of this area. One of these solutions, the point labelled “F” in Figure 6, is indicated in green (to the left of the thick bars) in Figure 5. This is the solution that produces the most output or value for a specified fixed budget. The present situation, or status quo, is represented by emboldened levels of effort in Figure 5. This is also shown in Figure 6 by the point labelled “P”. There are two other labelled points in this Figure. The “B” point

represents a solution that has roughly the same cost as “P” but provides a greater benefit and the “C” point represents a solution that has roughly the same value as “P” but costs less. The final points of note in Figure 5 are the red and blue arrows extending from certain levels of effort. The blue arrow indicates the last increase in a level of effort that was purchased to achieve the “F” point solution. The red arrow indicates the next level of effort that would be increased and indicates the next “optimal” solution along the frontier. In other words, those two arrows indicate which solutions are adjacent to the “F” point, on the frontier, in Figure 6. Note that in this case, those points also happen to lie on the “B” and “C” points. Generally, this is not the case.

37. The specific EQUITY model built for the ASX is explained in detail in §4.

### 3.4 ANALYTIC HIERARCHY PROCESS

38. Thomas L. Saaty developed the Analytic Hierarchy Process (AHP) [11] in order to aid decision makers to “view [their] problems in an organized [sic] but complex framework that allows for interaction and interdependence among factors and still enables [them] to think about [their problems] in a simple way.”<sup>3</sup> He goes on to say “The analytic hierarchy process ... provides such a framework. It enables us to make effective decisions on complex issues by simplifying and expediting our natural decision-making processes... The AHP also provides an effective structure for group decision making by imposing a discipline on the group’s thought processes.”<sup>4</sup>

39. The AHP was used during the ASX to aid in the development of the weightings for the EQUITY criteria. The procedure is described in detail in [12] and [13]. Briefly, the AHP exploits pairwise comparisons between elements to determine a prioritisation of the elements. The score assigned to option  $i$  compared with option  $j$  is determined based on the ranker’s preference for one over the other. These preferences are defined in Table II.

40. So, if option  $i$  is moderately or weakly more important or more valued than option  $j$ , then  $\frac{w_i}{w_j} = 3$  where  $w_i$  and  $w_j$  are the weights associated with options  $i$  and  $j$

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<sup>3</sup> Saaty, T.L., Decision Making for Leaders, RWS Publications, Pittsburgh, PA, 1990, pp. 4-5.

<sup>4</sup> *Ibid*, p. 5.

respectively. The AHP also implies that  $\frac{w_i}{w_j} = \frac{1}{3}$ . This process is repeated for each pair of options being weighted. The scores obtained through these pairwise comparisons are then normalised to find the individual preference weighting for each option. Note that

$$\sum_i w_i = 1$$

**TABLE II**  
**THE PAIRWISE COMPARISON SCALE [13]**

Intensity of Importance	Definition	Explanation
1	Equal importance.	Two elements contribute equally to the property.
3	Moderate importance of one over another.	Experience and judgement slightly favour one element over another.
5	Essential or strong importance.	Experience and judgement strongly favour one element over another.
7	Very strong importance.	An element is strongly favoured and its dominance is demonstrated in practice.
9	Extreme importance.	The evidence favouring one element over another is of the highest possible order of affirmation.
2, 4, 6, 8	Intermediate values between the two adjacent judgements.	Compromise is needed between two judgements.
Reciprocals	When activity $i$ compared to $j$ is assigned one of the above numbers, then activity $j$ compared to $i$ is assigned its reciprocal.	

41. The ASX was essentially an attempt at “group decision-making”. The AHP procedure is applicable for the individual ranking of weights. Hence, the assumption has been made that the pairwise comparisons have been assessed unanimously.

42. Particularly for larger option sets, it is likely that these ratios will contain some degree of inconsistency. In this context, inconsistency means that for some  $i, j$ , and  $k$

$$\left( \frac{w_i}{w_j} \right) \left( \frac{w_j}{w_k} \right) \neq \left( \frac{w_i}{w_k} \right)$$

43. The AHP provides a methodology by which the level of inconsistency in a set or pairwise comparisons can be measured. Saaty recommends that the decision-maker(s) resolve these inconsistencies however, he goes on to state that less than 10% is probably adequate for most purposes [13].

### **3.5 SCENARIO OPERATIONAL CAPABILITY RISK ASSESSMENT MODEL**

44. The Scenario Operational Capability Risk Assessment Model (SOCRAM) attempts to evaluate the effectiveness of a proposed force structure in meeting the operational demands generated by the concurrent occurrence of the FPS. The output of the model is a series of risk assessments. Systemic risk is expressed as the percentage of occurrences for which the force structure, which in this context is an inventory of operational assets, is incapable of meeting the deployment demands.

45. The scenarios (and more specifically, the variants thereof) are used in SOCRAM as the operational stimuli. Their activation creates the demand for operational assets. To determine the risk inherent in a force structure, SOCRAM uses the technique of simulation to generate a distribution of asset demand. In each iteration of a simulation run (SOCRAM typically uses 1000 iterations) scenario variants are activated based on their probability of occurrence and, if activated, a demand for operational assets is accrued. The risk is then simply the percentage of iterations of the simulation in which there was an insufficient amount of operational assets in the force structure to meet the total demand generated by the activated scenario variants.

46. SOCRAM is flexible enough to cater for nuances in CF policy. For example Assistant Deputy Minister (Policy) staff has determined that there are certain invalid combinations of activated scenarios i.e. the CF would not respond to all the scenarios in that combination. It is a simple matter to adjust SOCRAM to suit any number of invalid combinations. For the moment the rule set is that Scenarios 9, 10 and 11 (UN Chapter 7 Peace Support Operations, Defence of North America and Collective Defence, respectively) are mutually exclusive. Modifying this rule set permits policy options to be explored and sensitivity analyses to be conducted. A further example is the "early in, early out" concept concerning UN Chapter 6 Peace Support Operations (Scenario 6) which the Minister of National Defence has suggested. The number of rotations (sustainment) required for a particular scenario can be easily adjusted in SOCRAM and can be either a deterministic or probabilistic value.

47. The most crucial element of the SOCRAM process is the probability of occurrence (known in SOCRAM as the activation rate) for each scenario variant. Clearly accurate estimates for these are needed for the output of SOCRAM to have any validity. Values for the activation rates were determined through an analysis of all CF operations during the period 1947-1999. As a significant change followed the end of the cold war, the activation rates were biased towards the activation history in the 1990s. Further details can be found in [14].

48. Also required as input to the SOCRAM model were the amounts and types of operational assets needed to satisfy the mission requirements for each scenario variant. This data was acquired from several sources. The ASX Working Group<sup>5</sup> (ASX WG), and more specifically, DLSP staff, created the first set of data specific to the Army. Two syndicates at the ASX created alternate sets of data. Director Defence Analysis (DDA) staff crafted a final set after the ASX. These four sets of data provided a range of input values for SOCRAM, which led to a range of risk assessments for the proposed force structures.

49. SOCRAM is not a static model; rather it is continuously evolving as enhancements and increased functionality are added. For example, two features, substitution and consequence of failure, were developed to support the ASX.

50. Substitution arose naturally from the realisation of how the Army would respond to an activated scenario variant. The construct for substitution used for the ASX is shown in Figure 7. In some scenarios, specialised units would not be required and a more generalist unit could satisfy the mission requirements. For example, Variant 1 of Scenario 1 concerns a lost hunting party. It was felt that any Army unit could satisfactorily respond to this situation and more highly specialised soldiers are not necessarily required. Hence, in Figure 7, any unit to the left of the large green "Army" section can respond to that variant. By contrast, if a scenario variant calls for any Engineering unit, then either field or construction engineers can respond and the remainder are excluded. Finally, some scenario variants will require a specific unit type, e.g. Mechanised Infantry or Low-Level Air Defence. In these instances, only that unit type can respond and there can be no substitution. SOCRAM was adjusted

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<sup>5</sup> The ASX WG consisted of officers from the Land Staff with operational research support from the Land Forces and Strategic Planning Operational Research Teams, LFORT and SPORT, respectively. The members of the ASX WG handled the preparations for the ASX and all took part in the event. Their names are highlighted in the complete list of participants in Annex B.

to cater for substitutions of one unit-type for another. At this point, substitution is on a unit-for-unit basis. The feasibility of rating the unit equivalency is being considered.

51. The consequence of failure feature allows the analyst to identify the activated variants that were responsible for a shortfall in the amount of operational assets and assess the consequence of failing to meet this demand. The point being that the consequence of failure for all scenarios are not equivalent and so failing to have enough assets to complete the mission for one scenario can be more significant than in another. At the ASX a weighting factor reflecting the importance of each scenario was derived and this information was used to determine a consequence of failure score for the proposed force structures.

Speciality	Type	Function	Generic
Mechanized Infantry Light Infantry		Combat Arms	Army
Tanks Recce			
Artillery			
LLAD VSHORAD			
Field Engineers Construction Engineers		Combat Support	
Command Support			
General Service Support Close Service Support		Combat Service Support	
Military Police			
CIMIC			

Figure 7 – Construct for unit substitutability in SOCRAM.

52. One of the strengths of the SOCRAM methodology is its flexibility. This flexibility means that thorough sensitivity analyses can be conducted easily. This is especially important in the area of scenario variant activation rates. The activation rates are based on the CF experience since World War II. However, the future may not necessarily be the same as the past. SOCRAM can be used to investigate alternative futures by adjusting the scenario variant activation rates as required to more realistically reflect present international and domestic commitment levels. Alternatively, if the relative activation rates of the scenarios were predicted to remain

the same, but their relative importance was to change, various possible futures could be investigated by adjusting the consequence of failure weighting accordingly.

#### **4. ARMY SUSTAINABILITY EXERCISE PREPARATIONS**

53. Once the general model of the Army's functionality was developed, a detailed model that captured the broad spectrum of Army capabilities needed to be created. This model needed to capture the utility that the different Army units contribute to the whole, both while on operations and in garrison, and allow comparative assessments of these units to be done by the participants.

54. Criteria were necessary to allow the ASX participants to assess the change in utility that would be realised if the resources allocated to each of the unit types in the Army was increased or decreased. This valuation, in conjunction with the data collected by the ABC model, would enable a cost-benefit analysis that would determine where the Army feels its most capable assets are and how the Army's limited resources could best be applied to maximise the value of the Army as a whole.

55. It is worth noting at this point that for retreats of this nature, it is crucial that the participants "buy-in" to the process and the models being used. Hence it was acknowledged from the start that the ASX WG would build a "strawman" model, evaluation criteria and assessment mechanisms that would be presented to the ASX larger group. The participants would then be given the opportunity to evaluate and critique these initial proposals and would collectively make the final decisions on how to best generate the data required to feed the models and to achieve the aims of the ASX.

##### **4.1 INITIAL EXPLORATIONS / PREPARATIONS FOR THE WORKING GROUP TRIAL**

56. In keeping with the DND/CF move towards capability based planning, the initial concept was to investigate and evaluate the utility of the Army's various capabilities<sup>6</sup>. These Army capabilities were to be captured in EQUITY and

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<sup>6</sup> DPG 2001 [3] defines a capability to be "a function of the ability of a force to preplan a mission and its capacity to do so. It is generally a function of force structure (organization [sic] and equipment) plus training and logistic support. Capability may be defined as the ability to deal with the risks identified in the scenario associated with a Defence Mission Objective or the risks associated with actual operations. It includes the availability of personnel and materiel as well as a quantitative and qualitative assessment."

corresponding levels of effort could be defined that would represent the maintenance of the status quo, an increase in a particular area or a decrease. It was felt that this methodology would be best able to capture the current realities of the Army of Today, as well as aid the transition towards the Army of Tomorrow.

57. However, as this option was investigated more thoroughly, it became apparent that this would not be achievable. For the EQUITY cost benefit analysis to be valid, the capability areas and assessment criteria should be independent to the maximum extent possible. In reality, capabilities are complimentary and the majority of the time, Army units are employed in mutually supporting organisations. Yet for administrative convenience, in garrison they are grouped in units of like types. For instance, a battle group consists of a combination of infantry and armour with supporting artillery, engineers and other support trades tailored to the task at hand, such that the synergistic effects realised by combining the different units' capabilities are maximised. In practice, it is problematic to distinguish the costs associated with pure capabilities since for example, the division of the cost of a school or a collective training exercise among the various capabilities and also within actual organisational units is very difficult to determine with any precision.

58. While the capability based planning approach was not specifically used in this instance, the ASX participants were urged to maintain this mindset throughout the exercise. The authors recommend that a capability based planning approach be used where possible for similar activities in the future.

59. For the ASX, the approach adopted was to investigate the "value" or "benefit" of different levels of effort for each of the different unit types and mission elements in the Army. For the Regular force, the "units" were generally battalion sized, whereas the Reserve force "mission elements" corresponded to company sized organisations. These unit types are listed in Table III.

60. Additionally, since one of the objectives was to determine what type of activity levels would be sustainable for the new force structure, Regular Force units were assigned a readiness level of standard or high. The ATOF [15] outlines a new system of managed readiness for Army units. The high readiness units are fully manned, equipped and have undergone the collective training required for them to be deployable on mid-intensity operations with relatively short notice. By contrast, the standard readiness units are those that have either just come off high readiness and are in a re-constitution phase or are tasked to assist in the training of the next units to be

placed on high readiness. It was hoped during the planning phases of the ASX that comparing the utility of high and standard readiness units of the same type (e.g. mechanised infantry) would provide insight into the value for cost associated with the readiness and the activity levels that could be sustained indefinitely.

**TABLE III**  
**EQUITY CAPABILITY AREAS**

<b>Regular Force Units</b>	<b>Reserve Force Mission Elements</b>
Mechanised Infantry Battalion	Infantry Mission Element
Light Infantry Battalion	Armoured Mission Element
Armoured Regiment	Reconnaissance Mission Element
Artillery Regiment	Artillery Mission Element
Low-Level Air Defence Battery	Very Short Range Air Defence Battery
Very Short Range Air Defence Battery	Field Engineer Mission Element
Field Engineer Regiment	Service Battalion Mission Element
Engineer Support Regiment	Military Police Company
Close Support Service Battalion	
Military Police Platoon	
Command Support Battalion	
General Support Service Battalion	
Electronic Warfare (EW) Squadron	

61. These Regular Force building blocks (with their corresponding readiness levels) and Reserve mission elements comprised the capability areas in the EQUITY model and, hence, had levels of effort (number of units) assigned to them. The full EQUITY Army model that was taken into the ASX is shown in Figure 8. The unit types and their readiness levels are listed down the left hand side of the Figure. “HiR” indicates a high readiness unit and “StdR” is for standard readiness units. The levels of effort for each unit type extend to the right. One of the levels of effort for each unit type has been emboldened. This corresponds to the number of units of that type in the current force structure. For the Regular Force units, the current number of units and their readiness postures (typically one-third at high readiness and two-thirds standard readiness) were taken as a starting point and levels of effort above and below were included to consider both growth and unit closures. Initially this was not replicated for the Reserve Force because (1) DND/CF is in the midst of a Land Forces Reserve Restructure (LFRR) aimed at providing key guidance towards the future of the Reserves and (2) it was felt unlikely that a solution which increased the number of Reserve militia units would be achievable by 2004.

	1	2	3	4	5	6	7
<b>H&amp;R Mech Inf Bn</b>	5 Bn's	4 Bn's	3 Bn's	2 Bn's	1 Bn	0 Bn	
<b>StdR Mech Inf Bn</b>	6 Bn's	5 Bn's	4 Bn's	3 Bn's	2 Bn's	1 Bn	0 Bn
<b>H&amp;R Light Inf Bn</b>	4 Bn's	3 Bn's	2 Bn's	1 Bn	0 Bn		
<b>StdR Light Inf Bn</b>	4 Bn's	3 Bn's	2 Bn's	1 Bn	0 Bn		
<b>Res Inf Man Elm</b>	62 Elms	58 Elms	54 Elms	50 Elms	46 Elms	0 Elms	
<b>H&amp;R Armour Regt</b>	3 Regt's	2 Regt's	1 Regt	0 Regt			
<b>StdR Armour Regt</b>	3 Regt's	2 Regt's	1 Regt	0 Regt			
<b>Res Armour Man Elm</b>	15 Elms	13 Elms	11 Elms	9 Elms	0 Elms		
<b>Res Recce Man Elm</b>	9 Elms	7 Elms	5 Elms	0 Elms			
<b>H&amp;R Artillery Regt</b>	3 Regt's	2 Regt's	1 Regt	0 Regt			
<b>StdR Artillery Regt</b>	3 Regt's	2 Regt's	1 Regt	0 Regt			
<b>Res Artillery Man Elm</b>	21 Elms	19 Elms	17 Elms	15 Elms	0 Elms		
<b>H&amp;R LLAD Bty</b>	1 Bty	0 Bty					
<b>StdR LLAD Bty</b>	1 Bty	0 Bty					
<b>H&amp;R VSHORAD Bty</b>	3 Bty's	2 Bty's	1 Bty	0 Bty			
<b>StdR VSHORAD Bty</b>	3 Bty's	2 Bty's	1 Bty	0 Bty			
<b>Res VSHORAD Bty</b>	4 Elms	3 Elms	2 Elms	0 Elm			
<b>H&amp;R Field Engr Regt</b>	3 Regt's	2 Regt's	1 Regt	0 Regt			
<b>StdR Field Engr Regt</b>	3 Regt's	2 Regt's	1 Regt	0 Regt			
<b>Res Fd Engr Man Elm</b>	12 Elms	10 Elms	8 Elms	6 Elms	0 Regt		
<b>H&amp;R Engr Sp Regt</b>	1 Regt	0 Regt					
<b>StdR Engr Sp Regt</b>	1 Regt	0 Regt					
<b>H&amp;R CS Service Bn</b>	3 Bn's	2 Bn's	1 Bn	0 Bn			
<b>StdR CS Service Bn</b>	3 Bn's	2 Bn's	1 Bn	0 Bn			
<b>Res Svc Bn Man Elm</b>	22 Elms	20 Elms	18 Elms	16 Elms	0 Bn		
<b>H&amp;R Mil Police Pl</b>	3 Pl's	2 Pl's	1 Pl	0 Pl			
<b>StdR Mil Police Pl</b>	3 Pl's	2 Pl's	1 Pl	0 Pl			
<b>Res Mil Police Coy</b>	4 Coy's	3 Coy's	2 Coy's	1 Coy	0 Coy		
<b>H&amp;R Comd Sp Bn</b>	3 Sqn's	2 Sqn's	1 Sqn	0 Sqn			
<b>StdR Comd Sp Bn</b>	3 Sqn's	2 Sqn's	1 Sqn	0 Sqn			
<b>H&amp;R GS Service Bn</b>	3 Bn's	2 Bn's	1 Bn	0 Bn			
<b>StdR GS Service Bn</b>	3 Bn's	2 Bn's	1 Bn	0 Bn			
<b>Reg EW Sqn</b>	1 Sqn	0 Sqn					

Figure 8 – The ASX EQUITY Model.

62. The next step in the process of building an EQUITY model was to define the criteria to be used to determine the relative value of each of the capability areas. Four criteria were chosen by DLSP to represent the scope of the Army's key activities. These were:

- a. Scenarios. This criterion was designed to capture the utility of each capability portfolio element in regards to a response to the 11 Force Planning Scenarios (FPS).
- b. Taskings. The "Taskings" criterion measures the response that each unit or mission element can provide to support the Army's tasking load.
- c. Footprint. This criterion measures the effect and impact the unit or mission element has on the visibility of DND/CF within the country.
- d. Mobilisation. This criterion measures the contribution the unit or mission element has on the four-stage mobilisation framework. NATO defines mobilisation as "the act of preparing for contingencies, war or other emergencies, through assembling and organizing [sic] national resources, including routine operational functions, which require re-allocation of resources or reorganization [sic] of elements; and the process by which the armed forces or parts thereof are brought to a state of readiness for war or other national emergency. This includes assembling and organizing [sic] personnel, supplies and material for active military service."<sup>7</sup>

63. The above definitions represent the "final" ones that were approved and used at the ASX. For some of the criteria, several iterations and revisions were required to capture their precise meaning so that a consistent understanding was achieved among the ASX participants. This was particularly true for Mobilisation where there was a significant debate as to whether a unit that can achieve Level 3 mobilisation (force expansion) is actually of greater benefit than one that can be brought to Level 4 (national mobilisation). Among the criteria debated were the likelihood of occurrence and the specific role of DND/CF within the framework.

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<sup>7</sup> Canadian Forces and Department of National Defence Mobilization [sic] Planning Framework, 11 February 1999.

## **4.2 THE ASX WORKING GROUP TRIAL**

64. The ASX Working Group, comprised of Land Force planning staff and supporting OR analysts, met on 20-21 March 2001 to explore options and test the EQUITY model prior to the ASX. The aims of the trial were to:

- a. evaluate in detail the costing model being developed by the Comptroller;
- b. determine initial weightings for the four proposed criteria;
- c. finalise the “strawman” assessment mechanisms for the criteria within the EQUITY model; and
- d. confirm the validity of the EQUITY model by simulating the process of performing all the unit valuations.

### **4.2.1 Cost Model Examination**

65. A preliminary version of the complete ABC costing model was presented to the ASX WG at the trial. The members of the working group were given the opportunity to question and comment on the broad description of the expenditures that would be considered by this model. Unfortunately at the trial only a partial cost data set was available as the Army Comptroller had yet to complete the process of populating the cost model. This hampered the ASX WG's ability to fully test and verify the EQUITY model. It is recommended that for similar exercises in the future, the cost data be gathered as early in the planning process as possible so that it can be made available to the working group for their validation.

### **4.2.2 EQUITY Testing**

66. The EQUITY software allows the relative importance of each assessment criterion to be considered. The ASX WG used Saaty's AHP to generate an initial set of weights. It was recognised from the start that this process would need to be repeated at the start of the ASX and that the larger group would generate their own scale. The ASX WG's weights were only used to test the validity of the model. The weights developed by the ASX WG are given in Table IV:

**TABLE IV**  
**ASX WORKING GROUP**  
**CRITERIA WEIGHTINGS**

<b>Criteria</b>	<b>Weight</b>
Scenarios	60
Taskings	25
Footprint	5
Mobilisation	10

67. The ASX WG's next task was to determine a methodology for the ASX participants to assign values to each of the levels of effort for the capability areas. The ASX Trial was intended to further develop an understanding of the challenge that ASX participants would face. The ASX WG's efforts confirmed that guidelines were needed to provide the participants with a formalised definition of each criterion and to help them determine what score any given level of effort should be assigned. It was essential that individual participants be consistent when assessing the utility of the levels of effort for all the capability areas to minimise any skewing of the results. Due to the additive nature of the value scores in EQUITY, consistency between the participants was less critical.

68. The Scenarios criterion was designed to capture the utility of each capability portfolio element responding to the demands generated by the 11 FPS. Due to the broad scope of the set of FPS, the ASX WG determined that a more comprehensive view of the contribution each unit would make to this criterion could be achieved if each of the FPS was evaluated separately. It was concluded that this additional fidelity was well worth the additional effort. The AHP was used to determine the relative importance of each of the scenarios. The consequence of not having sufficient personnel, equipment or resources in the DND/CF inventory to complete each of the FPS individually was assessed. The likelihood of occurrence of the scenarios was intentionally not considered as it was recognised that SOCRAM provides this when it investigates the operational impacts of a force structure. The weights developed by the ASX WG are given in Table V.

69. According to the ASX WG, the evaluation of the consequence of not having sufficient resources to complete each the 11 scenarios divided them into three distinct classes. The low-end scenarios (1-6) all had a fairly low consequence and could be grouped and assessed together. Similarly, the middle three scenarios (7-9) and the last two (10-11) could be grouped. From the onset, it was understood that separating

this criterion into its 11 component scenarios would present a significant challenge to the analysts participating in the ASX due to the large amount of data to be gathered and analysed. However, this grouping of scenarios would help to reduce the amount of data to a more reasonable quantity. It was anticipated that the consequence weighting of the FPS by ASX participants would be roughly similar to that which the ASX WG found. However, as will be discussed below, this turned out not to be the case and forced a re-evaluation of the methodology by which the Scenarios criterion would be assessed.

**TABLE V**  
**ASX WG SCENARIO CONSEQUENCE WEIGHTING**

<b>Scenario</b>	<b>Description</b>	<b>Weight</b>
1	Search and Rescue in Canada	1
2	Disaster Relief in Canada	4
3	International Humanitarian Assistance	1
4	Surveillance / Control of Canadian Territory and Approaches	2
5	Evacuation of Canadians Overseas	4
6	Peace Support Operations (Chapter 6)	4
7	Aid of the Civil Power	14
8	National Sovereignty / Interests Enforcement	12
9	Peace Support Operations (Chapter 7)	10
10	Defence of North America	28
11	Collective Defence	19

70. The “Taskings” criterion measures the response that each unit or mission element can provide to support the Army’s tasking load. There are two dimensions that should be considered when performing a valuation for this criterion. First, the ability of a unit to provide individuals, sub-sub-units or sub-units should be considered. A unit with the ability to generate trained, cohesive sub-units should be valued higher than one that can only provide individual soldiers. Second, a unit with the ability to provide highly specialised personnel should score higher than one that can simply provide trained soldiers.

71. Similar to the development of the definitions for the criteria, these assessment guidelines underwent several iterations. Presented here for the Taskings criterion, and the remaining criteria below, are the final guidelines agreed upon by the participants at the ASX. The scale for this criterion is given in Table VI:

**TABLE VI**  
**VALUE GUIDELINES FOR THE TASKINGS CRITERION**

<b>Score</b>	<b>Definition</b>
0-33	Able to provide small numbers of Developmental Period <sup>8</sup> 2 or 3 (DP) personnel for training tasks and individuals for other tasks.
33-66	Able to provide moderate numbers of DP2/3 personnel for training tasks and up to sub-sub-units for other tasks.
66-100	Able to provide significant numbers of DP2/3 personnel for training tasks and up to sub-units for other tasks.

72. The Footprint criterion attempts to quantify the effect and impact the unit or mission element has on the DND/CF presence within the country. Clearly, the more units there are, the greater the potential for visibility across the country; the more types, the greater the appreciation of the range of DND/CF's mandate. The goal is to maximise DND/CF's visibility without applying funds and resources into units in locales that will only see a diminishing return on investment. The guidelines for the assessment of this criterion are given in Table VII:

**TABLE VII**  
**VALUE GUIDELINES FOR THE FOOTPRINT CRITERION**

<b>Score</b>	<b>Definition</b>
0-25	Little or no effect on the visibility of DND/CF within the country.
25-50	Minor effect on the visibility of DND/CF within the country.
50-75	Major effect and positive impact on the visibility of DND/CF within the country.
75-100	Significant and positive impact on the visibility of DND/CF within the country.

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<sup>8</sup> Developmental Period (DP) refers to the level of training a person has received. DP 2 corresponds to someone who is classification qualified. DP 3 would indicate some additional specialist training. For officers, this would typically mean Lieutenants and Captains and for non-commissioned members, these levels would be Master-Corporals.

73. Finally, the Mobilisation criterion is intended to measure the potential contribution the unit or mission element has on the four-stage mobilisation framework. As outlined in [16], the key elements of mobilisation are:

- a. personnel;
- b. force development;
- c. force structure;
- d. operations and planning;
- e. types of operations and tempo;
- f. recruiting and training;
- g. command and control;
- h. government activity; and
- i. mobilisation competencies.

74. Individual units and mission elements contribute in part to some or all of these elements should the requirement arise to transition to Mobilisation Stages 3 and/or 4. The assessment guidelines for this criterion are shown in Table VIII:

**TABLE VIII**  
**VALUE GUIDELINES FOR THE MOBILISATION CRITERION**

<b>Score</b>	<b>Definition</b>
0-25	Little or no contribution to achieving Stage 3 and Stage 4 mobilisation.
25-50	Minor contribution to achieving Stage 3 and Stage 4 mobilisation.
50-75	Moderate contribution to achieving Stage 3 and Stage 4 mobilisation.
75-100	Major to significant contribution to achieving Stage 3 and Stage 4 mobilisation.

75. Once the assessment mechanisms had been defined, the ASX WG embarked on an exercise to populate the EQUITY model. In order to save time, the WG carried out a single assessment of each of the capability areas as a group. It was, however,

understood by all that at the ASX itself, participants would submit anonymous ballots with individual utility assessments for the capability areas. This procedural shortcut precluded an evaluation of the amount of data that would be generated by the ASX participants and the time constraints that would result from the assimilation of this data into the EQUITY model.

76. The EQUITY solution derived from ASX WG inputs is shown in Figure 9. In this Figure, the EQUITY solution, which is the “optimal” or most highly valued force structure that is affordable and sustainable, is shown in green (to the left of the thick bars for each capability area). The set of distinct force structures that have the highest benefit scores over the total range of costs is known as the frontier. As above, the emboldened items represent the number of units in the Army of Today. One level of effort has a blue bar extending from the right and another had a red line that extends out to the left. These represent the “last” and “next” items purchased in order of funding. In other words, the force structure that has the same green boxes as the one shown in Figure 9, except there are only 10 Reserve Field Engineer Mission Elements, vice 12, is the EQUITY solution on the cost-effectiveness frontier that is slightly cheaper than the affordable solution. So, those two Reserve Field Engineer Mission Elements were the last items to be “purchased” and no other units may be added if the solution is to remain affordable. Similarly, the solution with two standard readiness Command Support Battalions (with the red line extending to the left from the thick green line) is a frontier solution that is slightly more expensive than that which is affordable.

77. As mentioned above, these results are based on incomplete costing data and, hence, are only representative of achievable outputs rather than prescriptive results, e.g., there was very little data available for the Reserve elements at the time, thereby artificially increasing their Value vs. Cost ratio. Still, even with the incomplete state of the model at that time, it was possible to verify that the model was responding as expected to increases or decreases in costs or value providing some degree of validation of the ASX model’s overall framework.

	1	2	3	4
<b>HiR Mech Inf Bn</b>	5 Bn's	4 Bn's	3 Bn's	2 Bn's
<b>StdR Mech Inf Bn</b>	6 Bn's	5 Bn's	4 Bn's	3 Bn's
<b>HiR Light Inf Bn</b>	3 Bn's	2 Bn's	1 Bn	
<b>StdR Light Inf Bn</b>	3 Bn's	2 Bn's	1 Bn	
<b>Res Inf Men Elm</b>	62 Elms	58 Elms	54 Elms	50 Elms
<b>HiR Armour Regt</b>	3 Reg'ts	2 Reg'ts	1 Regt	
<b>StdR Armour Regt</b>	3 Reg'ts	2 Reg'ts	1 Regt	
<b>Res Armour Men Elm</b>	15 Elms	13 Elms	11 Elms	9 Elms
<b>Res Recce Men Elm</b>	9 Elms	7 Elms	5 Elms	
<b>HiR Artillery Regt</b>	3 Reg'ts	2 Reg'ts	1 Regt	
<b>StdR Artillery Regt</b>	3 Reg'ts	2 Reg'ts	1 Regt	
<b>Res Artillery Men Elm</b>	21 Elms	19 Elms	17 Elms	15 Elms
<b>HiR LLAD Bty</b>	1 Bty	0 Bty		
<b>StdR LLAD Bty</b>	1 Bty	0 Bty		
<b>HiR VSHORAD Bty</b>	3 Bty's	2 Bty's	1 Bty	
<b>StdR VSHORAD Bty</b>	3 Bty's	2 Bty's	1 Bty	
<b>Res VSHORAD Bty</b>	4 Elms	3 Elms	2 Elms	
<b>HiR Field Engr Regt</b>	3 Reg'ts	2 Reg'ts	1 Regt	
<b>StdR Field Engr Regt</b>	3 Reg'ts	2 Reg'ts	1 Regt	
<b>Res Fd Engr Men Elm</b>	12 Elms	10 Elms	8 Elms	6 Elms
<b>HiR Engr Sp Sqn</b>	1 Sqn	0 Sqn		
<b>StdR Engr Sp Regt</b>	1 Regt	0 Regt		
<b>HiR CS Service Bn</b>	3 Bn's	2 Bn's	1 Bn	
<b>StdR CS Service Bn</b>	3 Bn's	2 Bn's	1 Bn	
<b>Res Svc Bn Men Elm</b>	22 Elms	20 Elms	18 Elms	16 Elms
<b>HiR Mil Police Pl</b>	3 Pl's	2 Pl's	1 Pl	
<b>StdR Mil Police Pl</b>	3 Pl's	2 Pl's	1 Pl	
<b>Res Mil Police Coy</b>	4 Coy's	3 Coy's	2 Coy's	1 Coy
<b>HiR Comd Sp Bn</b>	3 Sqn's	2 Sqn's	1 Sqn	
<b>StdR Comd Sp Bn</b>	3 Sqn's	2 Sqn's	1 Sqn	
<b>HiR GS Service Bn</b>	3 Bn's	2 Bn's	1 Bn	
<b>StdR GS Service Bn</b>	3 Bn's	2 Bn's	1 Bn	
<b>Reg EW Sqn</b>	1 Sqn	0 Sqn		

Figure 9 – ASX WG EQUITY Solution.

#### **4.2.3 SOCRAM Assessment**

78. SOCRAM also underwent significant testing and modification based on the discussions during the ASW WG trial. It was apparent that Scenario 6 demands are the key drivers; the requirement for sustainment is a major consumer of Army resources. Therefore, the historical database was revisited in order to validate and further refine the related activation rates modelled. Information concerning the number of rotations for all types of operations was gathered during this exercise to modify SOCRAM to more accurately represent the number of rotations of each activated scenario variant.

79. The reality of the current Army environment is that Scenario 6 commitments can be continuous. The concept of ongoing commitments was incorporated into SOCRAM for this reason and at the moment, only Scenario 6 variants are programmed to have an ongoing commitment. In effect, this means that for each iteration of a SOCRAM simulation run there is a possibility that new scenario variant activations can occur against the backdrop of an ongoing Scenario 6 commitment.

80. To further accurately reflect the Army environment, the ability to limit the number of activated scenario variants of the same type was refined within SOCRAM. This means that a limit can be placed on the total number of ongoing and new commitments for a particular scenario variant.

81. The pre-ASX trial was invaluable in tying together loose ends, simulating the type of discussion that could occur at the ASX and introducing methodological and model enhancements. It is recommended that prior to any event similar to the ASX, a detailed and rigorous trial be held.

## **5. CONDUCT OF THE ARMY SUSTAINABILITY EXERCISE**

82. The ASX was held at the Chateau Montebello in Quebec from 2-6 April 2001. In order to maximise the breadth of knowledge and experience present, senior officers from across the Army were invited to participate. This included Regular and Reserve Forces, staff officers and personnel currently in command positions in Army units and formations. Additionally, some delegates external to the Army participated. A complete list of attendees and their affiliations is given in Annex B. In total, some 61 participants took part in the ASX. To facilitate productive “brainstorming” activities, the participants were divided into five syndicates, each with a designated leader and a member of the ASX WG.

### **5.1 DAY 1**

83. The first day of the ASX was devoted largely to briefings intended to establish a shared appreciation of the context of the ASX within the larger scope of the Army’s current strategic initiatives, the affordability challenge facing the Land Forces and aim of the exercise. In his introductory remarks, MGen Dempster, Assistant Chief of the Land Staff (A/CLS) outlined the following objectives:

- a. to identify an optimum, balanced mix of structure and activities obtainable within allocated resource levels;
- b. to identify the additional resources needed if the structure and activities fall short of satisfying requirements; and
- c. to identify the principal constraints impeding transition to an affordable, balanced structure and options for surmounting resistance.

84. A/CLS underscored the aim of achieving a sustainable structure by 2004. He observed that crises provide both dangers and opportunities and noted a number of key corporate issues (e.g. follow-up to Crabbe-Mason Report on CF Command & Control, Stand up of the Joint Support Group (JSG) & National Military Support Capability, restructuring of the Canadian Forces Recruiting, Education and Training

System (CFRETS), initiation of a Program Review, etc.) which stand to have a significant impact on the Army structure.

85. Maj Leclair, DLSP 4-3, followed with a presentation on the Army's Performance Measurement Framework (PMF). It is based on PB Views software and includes five perspectives – Operational Forces, Army Team, Resource Management, Support to Government and Image – with appropriate subsets and indicators. The PMF is now in use and being calibrated, i.e. factor weights are being developed. Although the software is not yet mature enough to feed the ASX directly, the presentation prompted considerable discussion and assisted in identifying and clarifying issues.

86. The next presentation reviewed the tasks and resources assigned to the Land Forces and underscored the sustainment challenge facing the Army. The recurring annual deficit is approximately \$300M. This takes into account all funding sources from Defence Plan 01 (DP01) but does not consider capital expenditures. Concurrently CLS has a charge most recently reiterated in DP01 to modernise the Army. Further, the introduction of new equipment was likely to increase the demand on NP funding. This briefing served to outline the fiscal challenge.

87. Subsequently, Col Peters, Director Land Strategic Planning (DLSP), discussed force development activities underway and linked the Army Vision to Strategy 2020, Capability Based Planning and the Capability Goals Matrix. He drew attention to the Army's emerging Strategic Plan which focuses on four distinct themes (Connecting with Canadians, Shaping Army Culture, Delivering a Sustainable, Combat-Capable Force and Managing Readiness) and key Land Staff initiatives. His presentation served to establish the contextual background for the restructuring exercise.

88. After lunch, the Future Army Conceptual Framework was introduced. Directorate Land Strategic Change staff discussed general trends, the probable mission set and key attributes of the Future Army and force structure modelling conducted to date. Future capability requirements were framed in terms of effects (e.g. extended ranges, offensive information operations, advanced manoeuvre/firepower, close effects and sophisticated sensor systems) and enablers (e.g. full spectrum shields, tactical sustainment, and defensive information operations).

89. The next presentation was integral to the exercise's success. LCol Gunn outlined the value-for-cost methodology developed specifically to support the ASX.

He explained that costs had been captured and entered into a model, implemented by the EQUITY software package, to provide a Benefit vs. Cost analysis and to facilitate portfolio management. ASX participants were to assist in determining the relative value of portfolio elements. He noted that Force Generation and Support costs were largely dependent on the organisational construct driven by Operations, e.g. personnel, equipment and readiness/training posture of Army units. Hence it was proposed the evaluation focus on assessing unit “benefits” in terms of the following four criteria:

- a. the unit’s relative contribution to responding to Scenario demands;
- b. the unit’s relative contribution to force generation and ceremonial Taskings;
- c. the unit’s relative contribution to the preservation of a national Footprint and visibility of DND/CF within its community; and
- d. the unit’s relative contribution to maintenance of the potential for Mobilisation.

90. These criteria would in turn be weighted. The representative costs were then applied to derive “value-for-cost” data, and EQUITY used to derive “frontier points” and explore portfolio optimisation options.

91. To familiarise themselves with the AHP and the evaluation criteria, the ASX participants completed an exercise at the conclusion of these briefings. Syndicates were invited to assemble and discuss the merits of each of the criteria and their importance with respect to one another. Then, individually the participants conducted a pairwise comparison of the criteria using the Scale for AHP Preferences (Table II). The results, shown in Table IX, were tabulated and briefed in plenary session.

**TABLE IX**  
**ASX PARTICIPANTS**  
**CRITERIA WEIGHTING**

<b>Criteria</b>	<b>Weight</b>
Scenarios	57
Taskings	28
Footprint	7
Mobilisation	8
<b>Inconsistency</b>	<b>8%</b>

92. The final presentation of the day, “Creating a Managed-Readiness System”, proposed a tiered readiness concept and delineated in some detail representative Force Generation cycles based on three - Training, Operational and Reconstitution – cycles. The implications prompted considerable discussion, and were a pre-requisite to the ASX’s attempt to distinguish between High and Low Readiness units.

93. Two minor procedural points are worth mentioning. Each day prior to commencement of activities coloured index cards were distributed and the ASX participants were encouraged to submit suggestions. These were reviewed by A/CLS and staff overnight and a response prepared as the first order of business the following day. Secondly, syndicate leaders were invited to attend nightly staff meetings. This served two purposes. Organisers were better able to monitor concerns and adjust the program as required and syndicate leaders were better able to prepare and to direct syndicate activities.

## **5.2 DAY 2**

94. Day 2 opened with a detailed explanation of the ASX Costing Model. Salaries, capital equipment investment, individual and collective training, and proportional support costs were drawn from current units to derive representative cost data. The challenge involved in capturing accurate figures for the Reserves was revisited during the ASX and the Costing Model was refined so that the most realistic costing figures that could be derived were available for the EQUITY model.

95. After the presentation, the syndicates were invited to familiarise themselves with the CF Force Planning Scenario set. The participants were asked to individually weigh the scenarios in terms of the consequence to DND/CF of not being capable of meeting the demands (in terms of force structure, equipment, readiness levels, strategic mobility, etc.) of any given scenario. Again, the AHP was exploited to conduct pairwise evaluation. Because the likelihood of occurrence derived from historical analysis was featured in SOCRAM, participants were invited to focus on the criticality of the Army’s contribution as the prime factor. The results, shown in Table X, were instructive – they differed significantly from those arrived at during the pre-ASX Trial (Table V) revealing a more nationalistic leaning – and were discussed in plenary session.

**TABLE X**  
**ASX PARTICIPANTS SCENARIO CONSEQUENCE WEIGHTING**

<b>Scenario</b>	<b>Description</b>	<b>Weight</b>
1	Search and Rescue in Canada	7
2	Disaster Relief in Canada	16
3	International Humanitarian Assistance	4
4	Surveillance / Control of Canadian Territory and Approaches	9
5	Evacuation of Canadians Overseas	9
6	Peace Support Operations (Chapter 6)	4
7	Aid of the Civil Power	13
8	National Sovereignty / Interests Enforcement	10
9	Peace Support Operations (Chapter 7)	4
10	Defence of North America	16
11	Collective Defence	7
<b>Inconsistency</b>		<b>4%</b>

96. The next serial involved dividing into two groups. Syndicates 2 and 5 were asked to determine operational demands by scenario; that is, to review the FPS and propose a reasonable Army response to the mandated and implied taskings. The results were used to populate SOCRAM and provide a benchmark for later evaluation of force structure options. The ASX WG (DLSP staff) and syndicate responses are included in Annex C. Shown for comparison in that Annex is the set of demands developed by the staff in the DDA after the ASX. This solution attempted to reconcile the prior inputs.

97. The variance that is observed in the force requirements for the Scenarios is most likely due to the discretionary nature of the CF role and force contribution in operations. This is a consequence of the political process that determines the CF's role and contribution to an operational situation. Variation is an unavoidable result/effect of the process.

98. During the exercise the quantity versus quality dilemma was explored. Scenario 10 is particularly problematic. Developing a defence structure to defend Canadian territory autonomously, including critical infrastructure against asymmetric threats is clearly beyond our resources and modelling acceptable reliance on the US continues to be a challenge.

99. Concurrently, the remaining three syndicates attempted to evaluate unit portfolio elements (determine the relative value of the different units of arms and

readiness postures) for the Taskings, Mobilisation and Footprint criteria. A sample evaluation form is shown in Annex D. These results are presented below in §5.3.

100. A number of participants expressed discomfort with the initial criteria weights and requested an opportunity to repeat the exercise now that they had a better appreciation of the implications. Accordingly, the ASX participants conducted a subsequent pairwise comparison of the criteria. The results of the second assessment, shown in Table XI, validated the initial response and were ultimately the weightings that were used. Note that the degree of inconsistency among the voters did increase, but remains within acceptable limits [13].

**TABLE XI**  
**ASX PARTICIPANTS'**  
**CRITERIA WEIGHTINGS**

<b>Criteria</b>	<b>Initial Assessment</b>	<b>Second Assessment</b>
Scenarios	57	59
Taskings	28	26
Footprint	7	8
Mobilisation	8	7
<b>Inconsistency</b>	<b>8%</b>	<b>10%</b>

### **5.3 DAY 3**

#### **5.3.1 Initial Results**

101. The third day began with the ASX participants continuing to conduct unit and mission element valuations. In particular, they attempted to quantify the contribution that each makes to the Scenarios criterion. Upon completion, the data was tabulated and merged with the data from the other criteria. The initial results, shown in Figure 10, were presented in plenary session. The levels of effort depicted in green (to the left of the thick bars for each capability area) denote the optimal affordable force structure as determined by the EQUITY model. The lack of “heavy” units (mechanised infantry, armour and artillery), which are among the most expensive units in the Army, and are believed to be the most useful units in the Army, was not well received. Meanwhile, the “cheaper” units featured prominently in this initial EQUITY solution, and an increase in number from the present force structure was suggested in some instances.

- 40 -

	1	2	3	4	5	6	7
<b>HiR Mech Inf Bn</b>	5 Bn's	4 Bn's	3 Bn's	2 Bn's	1 Bn	0 Bn	
<b>StdR Mech Inf Bn</b>	6 Bn's	5 Bn's	4 Bn's	3 Bn's	2 Bn's	1 Bn	0 Bn
<b>HiR Light Inf Bn</b>	4 Bn's	3 Bn's	2 Bn's	1 Bn	0 Bn		
<b>StdR Light Inf Bn</b>	4 Bn's	3 Bn's	2 Bn's	1 Bn	0 Bn		
<b>Res Inf Men Elm</b>	62 Elms	58 Elms	54 Elms	50 Elms	46 Elms	0 Elms	
<b>HiR Armour Regt</b>	3 Regt's	2 Regt's	1 Regt	0 Regt			
<b>StdR Armour Regt</b>	3 Regt's	2 Regt's	1 Regt	0 Regt			
<b>Res Armour Men Elm</b>	15 Elms	13 Elms	11 Elms	9 Elms	0 Elms		
<b>Res Recce Men Elm</b>	9 Elms	7 Elms	5 Elms	0 Elms			
<b>HiR Artillery Regt</b>	3 Regt's	2 Regt's	1 Regt	0 Regt			
<b>StdR Artillery Regt</b>	3 Regt's	2 Regt's	1 Regt	0 Regt			
<b>Res Artillery Men Elm</b>	21 Elms	19 Elms	17 Elms	15 Elms	0 Elms		
<b>HiR LLAD Bty</b>	1 Bty	0 Bty					
<b>StdR LLAD Bty</b>	1 Bty	0 Bty					
<b>HiR VSHORAD Bty</b>	3 Bty's	2 Bty's	1 Bty	0 Bty			
<b>StdR VSHORAD Bty</b>	3 Bty's	2 Bty's	1 Bty	0 Bty			
<b>Res VSHORAD Bty</b>	4 Elms	3 Elms	2 Elms	0 Elm			
<b>HiR Field Engr Regt</b>	3 Regt's	2 Regt's	1 Regt	0 Regt			
<b>StdR Field Engr Regt</b>	3 Regt's	2 Regt's	1 Regt	0 Regt			
<b>Res Fd Engr Men Elm</b>	12 Elms	10 Elms	8 Elms	6 Elms	0 Regt		
<b>HiR Engr Sp Regt</b>	1 Regt	0 Regt					
<b>StdR Engr Sp Regt</b>	1 Regt	0 Regt					
<b>HiR CS Service Bn</b>	3 Bn's	2 Bn's	1 Bn	0 Bn			
<b>StdR CS Service Bn</b>	3 Bn's	2 Bn's	1 Bn	0 Bn			
<b>Res Svc Bn Men Elm</b>	22 Elms	20 Elms	18 Elms	16 Elms	0 Bn		
<b>HiR Mil Police Pl</b>	3 Pl's	2 Pl's	1 Pl	0 Pl			
<b>StdR Mil Police Pl</b>	3 Pl's	2 Pl's	1 Pl	0 Pl			
<b>Res Mil Police Coy</b>	4 Coy's	3 Coy's	2 Coy's	1 Coy	0 Coy		
<b>HiR Comd Sp Bn</b>	3 Sqn's	2 Sqn's	1 Sqn	0 Sqn			
<b>StdR Comd Sp Bn</b>	3 Sqn's	2 Sqn's	1 Sqn	0 Sqn			
<b>HiR GS Service Bn</b>	3 Bn's	2 Bn's	1 Bn	0 Bn			
<b>StdR GS Service Bn</b>	3 Bn's	2 Bn's	1 Bn	0 Bn			
<b>Reg EW Sqn</b>	1 Sqn	0 Sqn					
<b>Overhead</b>	Level 1						

Figure 10 – Initial EQUITY results. The items in green (to the left of the thick line for each capability area) denote the affordable EQUITY solution.

102. The ASX group immediately realised that this EQUITY solution did not at all reflect their vision for the stepping stone to the Army of Tomorrow that they were attempting to define. It was reiterated that EQUITY simply reflects *their* valuation and utilises a mathematical methodology to determine the “optimal” or most highly valued force structure option for a given cost. It does not “know” how to build a viable Army and it was up to the group as a whole to use the EQUITY output as the departure point for their syndicate discussions; *they* were invited to build that viable Army based on the initial EQUITY solution.

103. Through further discussions, both formal and informal, in plenary and with the ASX planning staff and syndicate leaders, it was determined that it was not possible for the ASX participants to assess the value of the number of units, of different types, that was being asked of them, with a sufficient degree of consistency. Essentially, it proved difficult to compare the portfolio elements as presented – to assess the trade-offs involved in comparing differing arms or unit types (e.g., light vs. mechanised infantry), numbers (diminishing returns), readiness postures and Regular and Reserve units (or “expensive” and “cheap” units) in one step and develop valid utility curves. This lack of consistency lead to an under-valuation of some units, and perhaps an over-valuation of others. Ultimately this “incorrect” data entered into the model would generate an unacceptable, if not invalid, solution. Hence, it was decided that a methodology to facilitate the “proper” scoring was required, particularly for the heavily weighted Scenarios criterion. Then the ASX participants would re-evaluate the contribution of portfolio elements to each scenario.

### **5.3.2 Redefining the Methodology for the Regular Force**

104. The planning staff and syndicate leaders worked through the evening to develop a more suitable methodology. First, the distinction between high and standard readiness postures was dropped. Instead of separate high and standard readiness mechanised infantry units, these were grouped and assessed together. The cost of this new mechanised infantry unit was assumed to be that of the high readiness unit. Secondly, Regular Force units were evaluated separately from Reserve Force mission elements and guidelines for the evaluation of the utility of the various unit types were developed.

105. In order to determine the utility of the Regular Force units in the Scenarios criterion for the EQUITY model, ASX participants were urged to first determine their “ideal” force package for each scenario. This was considered to be the number of

units of each type required to respond to the scenario demand. If indefinite sustainability was an issue for a given scenario (i.e. Scenario 6) they were to use the “4+1=5” rule. Then, for each scenario, participants were directed to assess the utility of each of the unit types. Once they had a score for the desired number of each unit types (e.g. 3 Mech Inf Bn’s) they evaluated the utility of having a greater number (e.g. 4 or 5 Mech Inf Bn’s) or fewer number (e.g. 1 or 2 Mech Inf Bn’s) of those units. It was recognised that as units are removed, there comes a point where essentially no capability (“the ability of a force to preplan a mission and its capacity to do so” from the definition) in that area remains, in spite of the fact that there may still be units. Conversely, as units are added, the marginal increase in capability eventually causes the value to “flat-line” and having more units does not provide more utility. The participants were advised that they could assign additional value to the core unit(s); so, if a particular scenario calls for an infantry-heavy combat team, the score that the mechanised infantry unit receives should be higher than the other units because it has a more significant role in that scenario. Col W Peters, DLSP, presented this new methodology in plenary at the start of Day 4. This presentation is found in Annex G.

106. The weights used for the individual scenarios were a potential concern. While the participants accepted that the likelihood of occurrence for each scenario would be handled by SOCRAM in due course, they felt uncomfortable assessing the FPS only in terms of the consequence of failure. They wanted to assess this consequence in conjunction with the likelihood that the scenario would be activated. To facilitate this, the participants were given summary sheets with the relative historical activation rate of each of the scenarios and they used the AHP to redefine the scenario weightings. These results, along with the initial assessments are given in Table XII.

107. The increases in the weights for Scenarios 3, 6 and 9 reflect the CF’s commitment to international operations. Conversely, the decrease in the weight for Scenarios 8 and 10 are perhaps indicative of a lack of an Army involvement in the former and a relatively low likelihood for the latter. These results do indicate a need for rationalisation with the missions for the Future Army as dictated by Army Council, presented in Appendix 5 to Annex A. Army Council has stated that the Future Army’s primary mission will be combat operations, from which two possibilities can be inferred. Either the scores for Scenarios 9, 10 and 11 should be higher, or if the scores presented in Table XII truly reflect the views of the future leadership of the Army then perhaps the priorities of the Army’s missions should be changed to more accurately reflect the current thinking.

**TABLE XII**  
**FORCE PLANNING SCENARIO WEIGHTINGS IN TERMS OF**  
**CONSEQUENCE OF FAILURE AND LIKELIHOOD OF OCCURENCE**

Scen.	Description	Consequence Only	Consequence & Likelihood	Delta
1	Search and Rescue in Canada	7	7	0
2	Disaster Relief in Canada	16	17	+1
3	Intl Humanitarian Assistance	4	8	+4
4	Surv / Control of Canadian Territory and Approaches	9	5	-4
5	Evac of Canadians Overseas	9	7	-2
6	Peace Support Ops (Ch 6)	4	17	+13
7	Aid of the Civil Power	13	12	-1
8	National Sovereignty / Interests Enforcement	10	4	-6
9	Peace Support Ops (Ch 7)	4	10	+6
10	Defence of North America	16	7	-9
11	Collective Defence	7	5	-2
Inconsistency		4%	6%	

108. The presentation of these new weights in plenary session and the development of the new valuation guidelines by the ASX planning staff and the syndicate leaders concluded the third day. It was decided that all of the syndicates would re-evaluate the capability areas (both Regular and Reserve Forces, albeit independently) in the Scenarios criterion on Day 4 and new options would be developed and discussed.

#### **5.4 DAY 4**

##### **5.4.1 Regular Force Re-Valuation**

109. The fourth day began with a presentation by Col Peters (Annex G). He outlined the new methodologies developed the previous evening and discussed illustrative examples of the application of the new standardised scoring system. With this new information, the syndicates broke away from the plenary session and began the new assessments.

110. This new data was used to re-populate the EQUITY model for the Regular Force. Results are presented graphically in Annex E and the complete set of data is available from the Operational Research Division (ORD) library. The resulting, affordable Army force structure is shown in Figure 11 and the Value vs. Cost for the

units is plotted in Figure 12. The green region in Figure 12 shows the complete solution space of benefit vs. cost for all possible force structures in Figure 11. Of course, those solutions that have benefit scores near the top of this region (near the frontier) are of greatest interest because they represent force structures that provide the greatest potential output for their cost. The point on the graph labelled "P" represents the value and the cost of the Present Army. Above that is the "B" point which lies on the frontier and represents a force structure that has a cost roughly equivalent to the "P" point, but has a greater value score. Conversely, the "C" point on the graph has roughly the same assessed value as the "P" point but is cheaper. Finally, the "F" point represents an affordable force structure for the Army, which has the highest value for that cost. The location of the "F" point is an *input* to the model. EQUITY does not aid the user to determine what can be afforded; rather this is determined by budgetary constraints. Note that for all Value vs. Cost plots, the costs are in Thousands of dollars.

<b>Equity Force Structure for Regular Force Units</b>								
	7 Bn's	6 Bn's	5 Bn's	4 Bn's	3 Bn's	2 Bn's	1 Bn	0 Bn
<b>Mech Inf Bn</b>								
<b>Light Inf Bn</b>	4 Bn's	3 Bn's	2 Bn's	1 Bn	0 Bn			
<b>Armour Regt</b>	4 Regt's	3 Regt's	2 Regt's	1 Regt	0 Regt			
<b>Artillery Regt</b>	4 Regt's	3 Regt's	2 Regt's	1 Regt	0 Regt			
<b>LLAD Bty</b>	2 Bty's	1 Bty	0 Bty					
<b>VSHORAD Bty</b>	2 Bty's	1 Bty	0 Bty					
<b>Field Engr Regt</b>	4 Regt's	3 Regt's	2 Regt's	1 Regt	0 Regt			
<b>Engr Sp Regt</b>	2 Regt's	1 Regt	0 Regt					
<b>CS Service Bn</b>	4 Bn's	3 Bn's	2 Bn's	1 Bn	0 Bn			
<b>Comd Sp Bn</b>	4 Bn's	3 Sqn's	2 Sqn's	1 Sqn	0 Sqn			
<b>Overhead</b>	Parked Elements							

Figure 11 – EQUITY Force Structure for Regular Force Units.

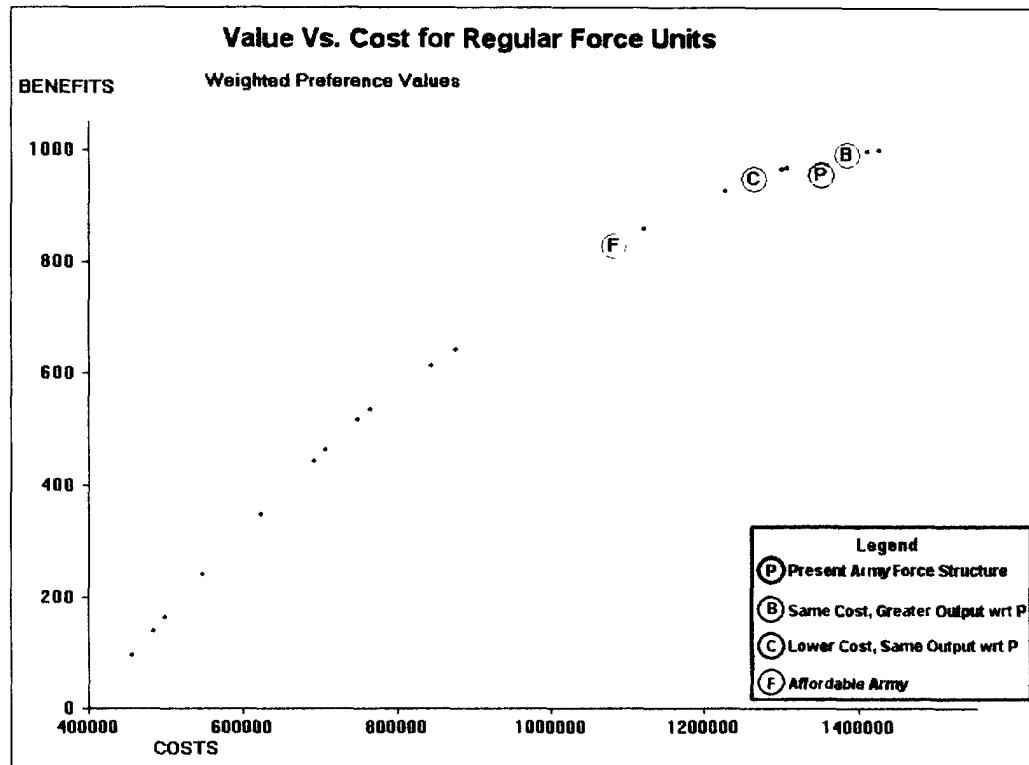


Figure 12 – Value vs. Cost for Regular Force Units (initial results presented at the ASX).

111. The first interesting observation that can be made from Figure 12 is that the “P” point is very close to the frontier. While not intuitively obvious, this is indicative of the fact that over the years, the Army has evolved to become fairly effective at maximising its utility, or at least at aligning its structure and value sets. Given that the participants’ views reflected ingrained corporate utility assessments, it is natural that the present force structure would lie relatively near to the efficiency frontier.

112. The fundamental issue is that the cost of the existing Army structure is greater than the allocated budget can support. The need exists to re-structure, in an optimal manner, to live within the forecasted funding envelope. The gap on the horizontal axis between the “P” and the “F” points in Figure 12 is significant and illustrative. At this point in the ASX, the syndicates were given representative unit costs and were asked to explore options – to take the EQUITY solutions and using them as a departure point, propose a viable force structure for the Army. The only substantive caveat was that any modifications that they made to the EQUITY solutions in the formulation of their own solutions had to be relatively cost neutral. Two of the syndicates were assigned the “F” point and a third was assigned to investigate the “C”

point. Due to the large gap between “F” and “P”, a mid-point “M” was defined<sup>9</sup> approximately halfway between “F” and “C”, and the last two syndicates used “M” as their starting point. The EQUITY force structures for “F”, “M” and “C” are given in Table XIII. The syndicate solutions are discussed in Chapter 6.

113. When the final costing data became available for post-analysis after the ASX, it was found that the “F” point was misrepresented during the actual event. This occurred because the assumed ratio of the budgets of the Regular and Reserve Forces remained constant. Based on the recommendation of DLSP staff, it was assumed that the Regular Force consumes three-quarters of the Army’s budget and the Reserve Force consumes the remaining quarter. As the cost model was presented to the ASX participants, it was determined that the cost of the Reserves was over-estimated. Thus, additional resources became available to the Regular Force, hence the “F” point was moved to the right in the Value vs. Cost diagrams. A corrected version of Figure 12 is shown in Figure 13. In effect, the true “F” point is not as far removed from the “C” point as was originally thought. Further, this would suggest that the results generated by the syndicates that investigated the “M” and “C” points would be more relevant, and perhaps those by the syndicates that looked at the original “F” point should be viewed as absolute worst-case scenarios.

**TABLE XIII**  
**EQUITY SOLUTIONS FOR THE REGULAR FORCE**

Unit Types	Present “P”	Affordable “F”	Mid-Point “M”	Same Value/ Lower Cost “C”
Mech Infantry Bn	6	4	4	4
Light Infantry Bn	3	4	4	4
Armoured Regt	3	1	2	3
Artillery Regt	3	0	1	2
LLAD Bty	1	1	1	1
VSHORAD Bty	1	2	1	2
Fd Engineer Regt	3	3	3	3
Engineer Sp Regt	1	1	1	1
CS Service Bn	3	3	3	3
Command Sp Bn	3	3	2	3

<sup>9</sup> Note that not all the capability areas in the “M” point have levels of effort between those in the “F” and “C” point. The “M” point was chosen to representative a solution whose cost was half-way between “F” and “C” and whose assessed value was close to the frontier.

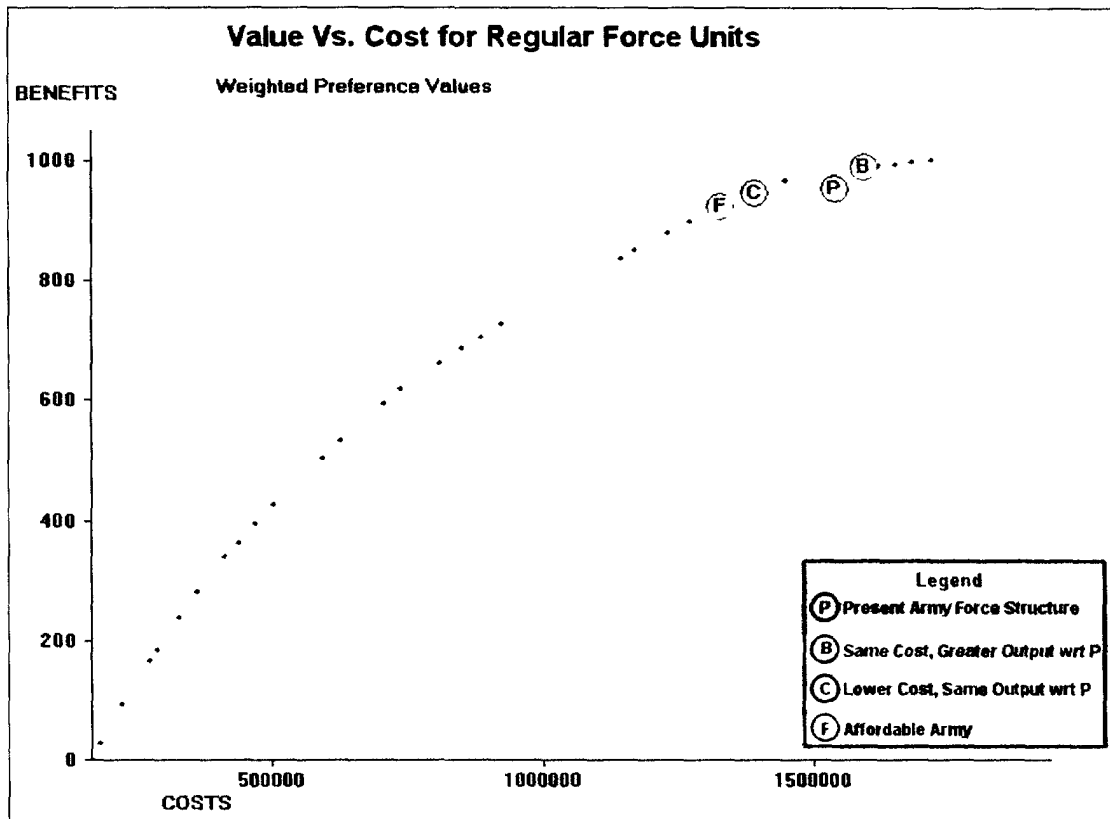


Figure 13 – Value vs. Cost for Regular Force Units (corrected cost data created after the ASX).

#### 5.4.2 Redefining the Methodology for the Reserve Force

114. The contribution of Reserve Force mission elements to the Force Planning Scenarios proved to be even more challenging to assess consistently than the Regular Force units. As indicated above, e.g. Figure 10, the Reserve Force mission elements were assessed simultaneously with their Regular Force counterparts. The ASX participants had significant difficulties in attributing value scores to the Reserve mission elements that were both consistent with much more expensive and much higher scoring Regular Force units and that correctly captured their views of the true value of output that the Reserves provide. This was particularly difficult in the Scenarios criterion due to the fact that Reserve mission elements typically provide individual augmentation to Regular Force operations, rather than providing formed units, sub-units or sub-sub-units.

115. A simple methodology was developed to allow the participants to determine where the point of diminishing returns for Reserve units lay. The following assumptions were made and offered to the group:

- a. each Regular Force unit will deploy with 20% of its Table of Operations and Equipment (TO&E) as Reservists;
- b. to generate one Reservist for deployment requires five Reservists; and
- c. casualty rates in the offensive phase of war are 20% of the TO&E for every 60 days.

116. Specific establishment sizes for the different unit types were then defined for both Regular and Reserve Force units, as shown in Table XIV.

117. So for instance, to deploy a mechanised infantry battalion, the TO&E calls for 694 personnel. Twenty percent of that corresponds to approximately 140 Reservists. To generate 140 Reservists requires a total of five times that many or about 700. At 155 Reservists per infantry mission element, this calls for about five Reserve infantry mission elements to generate enough support for a six-month deployment of a mechanised infantry battalion. Of course, having additional reserve mission elements increases the likelihood that there will be sufficient numbers of available soldiers when required.

**TABLE XIV**  
**REGULAR AND RESERVE FORCE ESTABLISHMENT SIZES**

<b>Regular Force</b>		<b>Reserve Force</b>	
<b>Unit Type</b>	<b>Personnel</b>	<b>Unit Type</b>	<b>Personnel</b>
Mech Inf Bn	694	Inf Msn Elm	155
Lt Inf Bn	520		
Armd Regt	506	Armd Msn Elm	116
Armd Sqn	140		
Recce Sqn	140	Recce Msn Elm	114
VSHORAD Bty	108	VSHORAD Msn Elm	160
Fd Arty Regt	476	Fd Arty Msn Elm	129
Fd Engr Regt	345	Fd Engr Msn Elm	129
CS Svc Bn	475	CS Svc Bn Msn Elm	142
GS Svc Bn	649		

118. With this knowledge, the ASX participants were better able to evaluate the utility of the Reserve Force units in the Scenarios criterion, which permitted a cost-benefit analysis for the Reserve Force, independent from the Regular Force. However, the goal of the ASX was to optimise the Army as a whole, so the syndicates were asked to develop “bridging factors” or conversions for each of the Reserve Force unit types to express the value (as a percentage) of the Reserve unit compared to the Regular Force unit. These factors included consideration of the personnel establishments, training and equipment issues.

119. The ASX participants again acknowledged the difficulties they were having at differentiating the varying levels of Reserve capabilities. They realised that they were in danger of treating the Reserve Force as a large human resources pool. An attempt was made to determine methods of enhancing the value of the Reserve structure within the current resource allocation. Syndicates were tasked to consider the implication of the Regular Force option they were investigating on the Reserve Force and to suggest innovative ways of building new Reserve Force value. Finally, they were invited to relate how this new value would impact their Regular Force option and the overall capability of the Army.

120. In a similar vein to the Regular Force, the value of the Reserve Force units was re-assessed in the Scenarios criterion. These results (for the Reserve Force alone) are shown in Figure 14 and Figure 15.

<b>Equity Force Structure for Reserve Force Units</b>						
<b>Res Inf Msn Elm</b>	66 Elms	62 Elms	58 Elms	54 Elms	50 Elms	46 Elms
<b>Res Armour Msn Elm</b>	17 Elms	15 Elms	13 Elms	11 Elms	9 Elms	0 Elms
<b>Res Recce Msn Elm</b>	11 Elms	9 Elms	7 Elms	5 Elms	0 Elms	
<b>Res Arty Msn Elm</b>	23 Elms	21 Elms	19 Elms	17 Elms	15 Elms	0 Elms
<b>Res VSHORAD Bty</b>	5 Elms	4 Elms	3 Elms	2 Elms	0 Elm	
<b>Res Fd Engr Msn Elm</b>	14 Elms	12 Elms	10 Elms	8 Elms	6 Elms	0 Elms
<b>Res Svc Bn Msn Elm</b>	24 Elms	22 Elms	20 Elms	18 Elms	16 Elms	0 Bn
<b>Overhead</b>	<b>Parked Elements</b>					

Figure 14 – EQUITY Force Structure for Reserve Force Units.

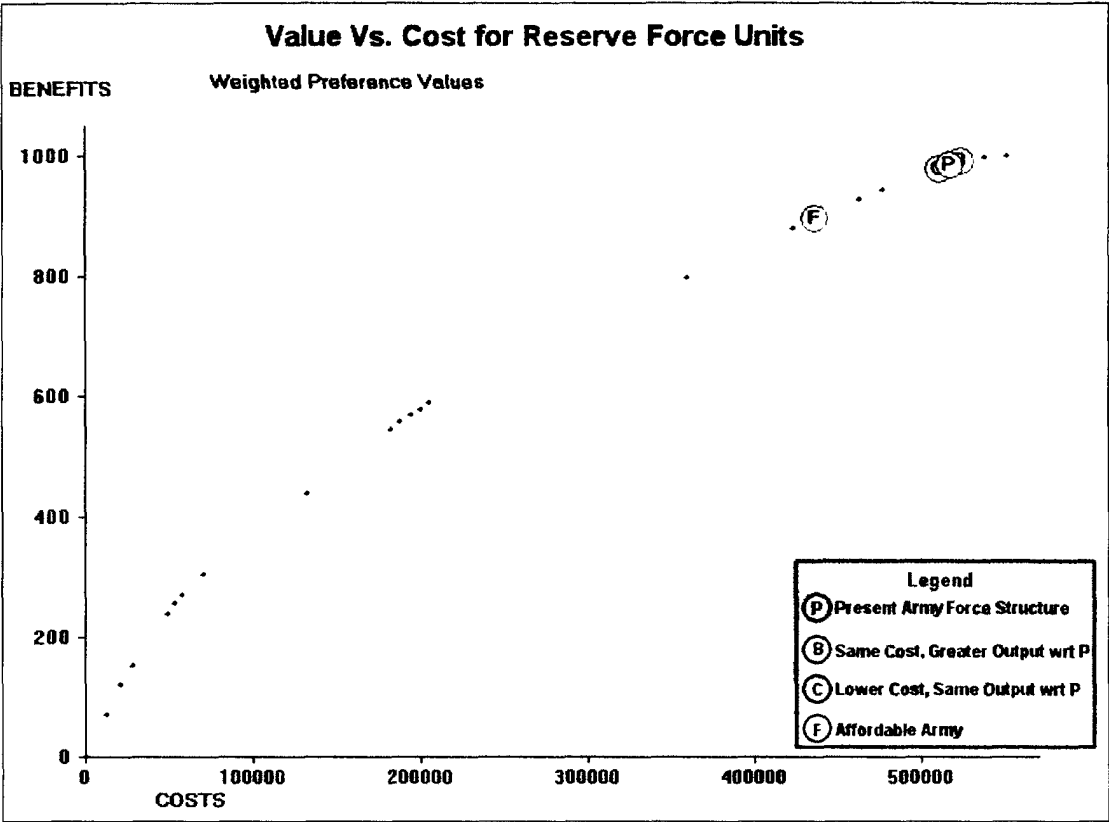


Figure 15 – Value vs. Cost for Reserve Force Units (corrected cost data).

121. In addition to developing new assessments of the value of the Reserve units, the syndicates produced bridging estimates to allow a direct comparison of the contribution of Regular and Reserve units to the Force Planning Scenarios. These are summarised in Table XV.

**TABLE XV**  
**RESERVE BRIDGING SCORES**

Regular Force Unit/Sub-Unit	Reserve Force Unit	Percentage of Regular Force Value
Light Infantry Bn	Infantry Bn	13%
Armoured Regt	Armoured Regt	7%
Armoured Regt	Recce Regt	10%
Artillery Regt	Fd Artillery Regt	13%
VSHORAD Bty	VSHORAD Bty	50%
FD Engineer Regt	FD Engineer Regt	13%
CS Service Bn	Service Bn	12%

122. For the remainder of the fourth day, the syndicates pursued their investigation of the assigned EQUITY solutions and refinement of solutions for presentation to the Chief of the Land Staff (CLS) and visitors from Army Council, the Director of Defence Analysis (DDA) and the Director of Strategic Change (DSC) on Day 5.

## **5.5 DAY 5**

123. The bridging scores enabled a Total Force cost-benefit analysis. The resulting force structure and Value vs. Cost plot were presented to the ASX Participants in plenary at the start of Day 5 and later to the visitors. These are given in Figure 16 and Figure 17 respectively. The plenary group was much more satisfied with these results than those originally presented (Figure 10).

124. The CLS and visitors arrived later Friday morning and were presented an overview of the week – the aim of the exercise, methodologies and general observations were explained. Subsequently, the syndicates were invited to present their “solutions” and share insights gained and concerns noted. The ASX concluded with an address by the CLS, a personal view of the direction of the Army in the coming years, and a question and answer period.

Equity Force Structure for Regular and Reserve Force Units							
Mech Inf Bn	7 Bn's	6 Bn's	5 Bn's	4 Bn's	3 Bn's	2 Bn's	1 Bn
Light Inf Bn	4 Bn's	3 Bn's	2 Bn's	1 Bn	0 Bn		
Res Inf Men Elm	66 Elms	62 Elms	58 Elms	54 Elms	50 Elms	46 Elms	0 Elms
Armour Regt	4 Regt's	3 Regt's	2 Regt's	1 Regt	0 Regt		
Res Armour Men Elm	17 Elms	15 Elms	13 Elms	11 Elms	9 Elms	0 Elms	
Res Recce Men Elm	11 Elms	9 Elms	7 Elms	5 Elms	0 Elms		
Artillery Regt	4 Regt's	3 Regt's	2 Regt's	1 Regt	0 Regt		
Res Artillery Men Elm	23 Elms	21 Elms	19 Elms	17 Elms	15 Elms	0 Elms	
LLAD Bty	2 Bty's	1 Bty	0 Bty				
VSHORAD Bty	0 Bty	1 Bty	0 Bty				
Res VSHORAD Bty	0 Elm	4 Elms	3 Elms	2 Elms	0 Elm		
Field Engr Regt	4 Regt's	3 Regt's	2 Regt's	1 Regt	0 Regt		
Res Fd Engr Men Elm	14 Elms	12 Elms	10 Elms	8 Elms	6 Elms	0 Regt	
Engr Sp Regt	2 Regt's	1 Regt	0 Regt				
CS Service Bn	4 Bn's	3 Bn's	2 Bn's	1 Bn	0 Bn		
Res Svc Bn Men Elm	24 Elms	22 Elms	20 Elms	18 Elms	16 Elms	0 Bn	
Comd Sp Bn	4 Bn's	3 Sqn's	2 Sqn's	1 Sqn	0 Sqn		
Overhead	Parked Elements						

Figure 16 – EQUITY Force Structure for Regular and Reserve Force Units.

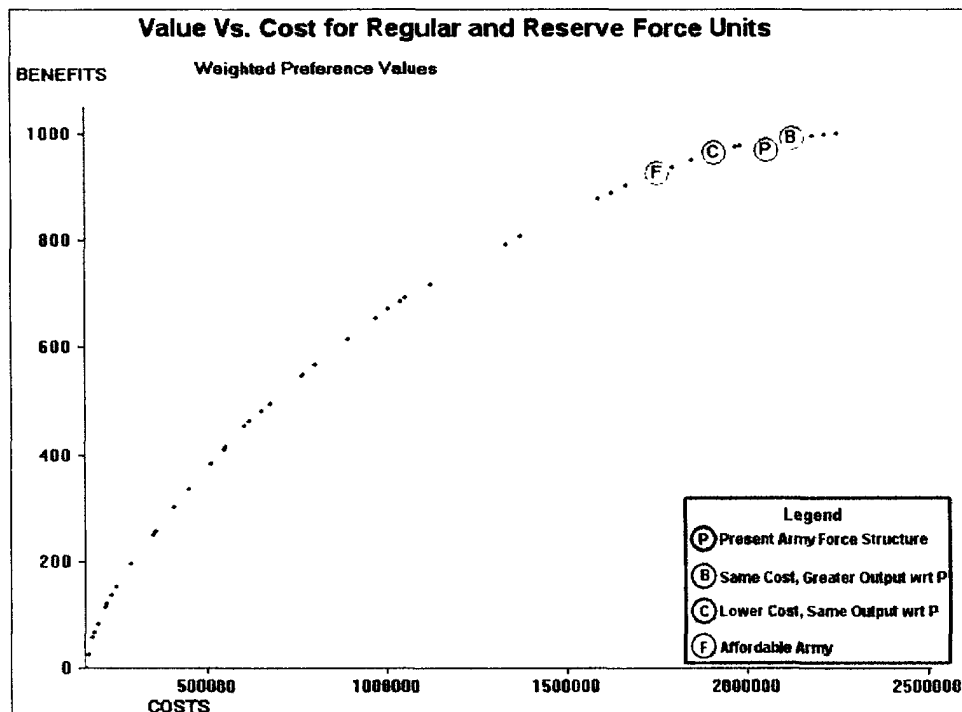


Figure 17 – Value vs. Cost for Regular and Reserve Force Units (corrected cost data).

## **6. RESULTS**

125. From the outset, the ASX planning staff realised that the results from the ASX would not be the outputs from the EQUITY model. Rather, these EQUITY results would serve as inputs to syndicate discussions. The combined and synergistic knowledge and experience of the ASX participants would be exploited to develop achievable force structure options that could be considered for the Army of 2004. These are summarised in §6.1.

126. Based on these syndicate solutions, further analysis was possible. All of the detailed analyses reported in the remainder of this chapter were completed after the ASX, as there was very little time for such considerations during the actual event. It is noteworthy that the majority of the ASX participants have not yet had the opportunity to review or comment on these results.

### **6.1 SYNDICATE SOLUTIONS**

127. As mentioned above, each of the five syndicates was assigned one of the EQUITY “F”, “M” or “C” points and the corresponding EQUITY portfolio. They were asked to use it as the basis for building a viable Army. The only limitation imposed on the syndicates was that their viable Army had to be fairly cost neutral compared with their original point of departure. Each syndicate presented their results in a plenary session. The presentations are contained in Annex F. Syndicate results are described briefly below.

#### **6.1.1 Syndicate 1**

128. Syndicate 1 examined the structural options at Point “F” and examined both two and three brigade group options. Common to both options was a projected saving achieved by personnel reductions in the order of 3000 PYs and adopting a tiered readiness posture -  $\frac{1}{3}$  of the Land Forces would remain on High Readiness. The two-brigade option was preferred although it was noted that sustainment beyond one battle group and one other tasking was problematic and reliance would have to be placed on the Joint Headquarters to complement the rotation and provide the third

Command Support Battalion. To increase the value of the Reserves, Syndicate 1 proposed continued integration, migration of some Tank and Artillery tasks and consideration of specialised roles, e.g. CIMIC, PSYOPS.

#### **6.1.2 Syndicate 2**

129. Syndicate 2 began at the Mid-Point and also examined two and three brigade group options. Their refinements to the EQUITY solution reflected a decided preference for Mechanised Infantry in lieu of Light Infantry. In the two-brigade option the Syndicate opted to cash in Light Infantry to invest in more Mechanised Infantry and preserve additional Armoured and Artillery Support. In the three-brigade option they proposed to combine Mechanised and Light Infantry Battalions and “mechanise” 75% of the resultant hybrid. A tiered readiness posture was suggested. Syndicate 2 suggested that in the three-brigade option the Regular/Reserve mix for Armoured and Artillery Regiments be 60/40 and 40/60 respectively, i.e. one Recce Squadron and 2 Batteries be assigned to the Reserves. Additionally it was recommended that Stage 3 and 4 Mobilisation targets be better defined.

#### **6.1.3 Syndicate 3**

130. Syndicate 3 reviewed the model derived from EQUITY Point “C”. They concluded, as Syndicate 2 had, that Light Infantry was overvalued in comparison to Mechanised Infantry and that the current Armoured Regiment construct should be reviewed. This reflected a recurring theme – the immediate demand for Recce elements far exceeded the demand for tanks. Syndicate 3 also determined that the second VSHORAD Battery in the model was not required. Projected savings from adoption of a tiered readiness posture were again factored in and used in part to “mechanise” two of the Light Infantry battalions. The Syndicate noted that the reductions in Standing Forces provided scope for Reserve Forces to restore capability. Light Infantry, Artillery, Light Recce and General Support Engineering roles were suggested, as was reinforcement of success in specialist roles such as Intelligence Companies and CIMIC.

#### **6.1.4 Syndicate 4**

131. Syndicate 4 was invited to apply best military judgement to Point “F”. They refined the “solution” by reducing three units from High Readiness to Standard Readiness and substituting an Artillery Regiment and an Armoured Regiment for

LLAD and VSHORAD batteries in the Regular Forces. To increase the value of the Reserves, Syndicate 4 proposed clarifying mission definition, rationalising the C2 overhead and maintaining specialised capabilities, e.g. CIMIC and PSYOPS. Adjustments to the Reserve Force Structure might include less emphasis on Infantry and Armoured roles and more emphasis on Artillery, Engineering and Service Support roles.

#### **6.1.5 Syndicate 5**

132. Syndicate 5 examined the optimisation options about the Mid-Point. Again, both two and three-brigade alternatives were considered. Savings generated through managed readiness, transferring the LLAD role to the Reserves and reducing the number of Engineering and Service Battalions from three to two permitted an additional Mechanised Infantry Battalion to be added to each of the two brigades. It also freed up two companies' worth of mechanised equipment for allocation to CMTC. The alternative (three-brigade option) proposed trading off Air Defence assets for additional Command Support and a Light Infantry Battalion and accepting asymmetric mixes (Light vs. Mechanised Infantry and Armoured vs. Recce) in the brigade structure. Syndicate 5 envisaged assignment of greater responsibility for Air Defence to the Reserves.

#### **6.1.6 Summary**

133. Table XVI summarises the departure points and syndicate solutions presented for the Regular Force. The "Present" column depicts the Army of Today and the "Affordable" column is the solution provided by the EQUITY model. The row entitled "ASX Point" shows the departure point assigned to the syndicates. The "Value" row was derived from the assessments of the capability areas, using the weighted criteria. Finally, the costs were determined from the ASX Costing Model and represent a minor refinement from the departure point.

134. The Army Transformation Working Group (ATWG) also developed several force structures for an Army of Tomorrow independently, prior to the ASX. Their "Option C" has been included here and below for comparison. There does exist the potential for confusion between this Option C and the EQUITY "C" point described above. These are different and will be referred to as "Option C" and the "C point", respectively.

**TABLE XVI**  
**SYNDICATE SOLUTIONS FOR THE REGULAR FORCE<sup>10</sup>**

	Pres	EQUITY	Syn 1a	Syn 1b	Syn 2a	Syn 2b	Syn 3	Syn 4	Syn 5a	Syn 5b	ATWG Option C
Mech Inf	6	4	6	5	6	8	6	4	6	4	7
Lt Inf	3	4	0	0	0	0	2	4	0	5	0
Armd	3	2	2	3	2	3	2	1	2	2	3
Arty	3	2	1	1	2	3	2	1	1	1	3
SHORAD	1	1	1	1	2	0	1	0	0	0	0
VSHORAD	1	2	1	1	2	1	1	0	1	0	1
Fd Engr	3	3	2	3	2	3	3	3	2	3	3
Engr Sp	1	1	1	1	0	1	1	1	1	1	0
CS Svc Bn	3	3	2	3	2	3	3	3	2	3	3
Comd Sp	3	3	2	3	2	3	3	3	2	3	3
GS Svc Bn*	3	3	3	3	3	3	3	3	3	3	3
EW*	1	1	1	1	1	1	1	1	1	1	1
MP*	3	3	3	3	3	3	3	3	3	3	3
ASX Point	"P"	"F"	"F"	"F"	"M"	"M"	"C"	"F"	"M"	"M"	
* For simplicity, these units were "parked" and not assessed. Current inventories were assumed.											
Value	953	923	713	777	700	798	888	791	676	821	744
Cost (\$M)	\$1,540	\$1,328	\$1,136	\$1,218	\$1,194	\$1,446	\$1,379	\$1,147	\$1,177	\$1,210	\$1,407

135. Note that in Table XVI, the solutions "2b" and "5a" called for eight Mechanised Infantry Battalions, and solution "5b" called for five Light Infantry Battalions. However, valuations were obtained only for a maximum of seven mechanised units and four light units. Hence the values and the costs for those syndicate solutions are given as though these maximums were specified.

136. These syndicate solutions have been plotted on a Value vs. Cost plot that is shown in Figure 18 and enlarged to show greater detail in Figure 19. Most of the syndicate solutions fall inside the affordability region, however, many are also fairly far below the efficiency frontier. This is not necessarily undesirable and reflects the difficulty that the ASX participants had in properly evaluating the capability areas and levels of effort. The fact remains that the Army must decide on an affordable force structure that it is comfortable with and that is capable of meeting its missions and tasks, regardless of where the point falls on a cost-benefit curve.

<sup>10</sup> Note that some of the values for the EQUITY solution in this table differ from those presented elsewhere, e.g. Figure 16. This is because Table XVI shows the solution for the Regular Force only as this was what the syndicates were asked to investigate. Conversely, Figure 16 is a Total-Force solution.

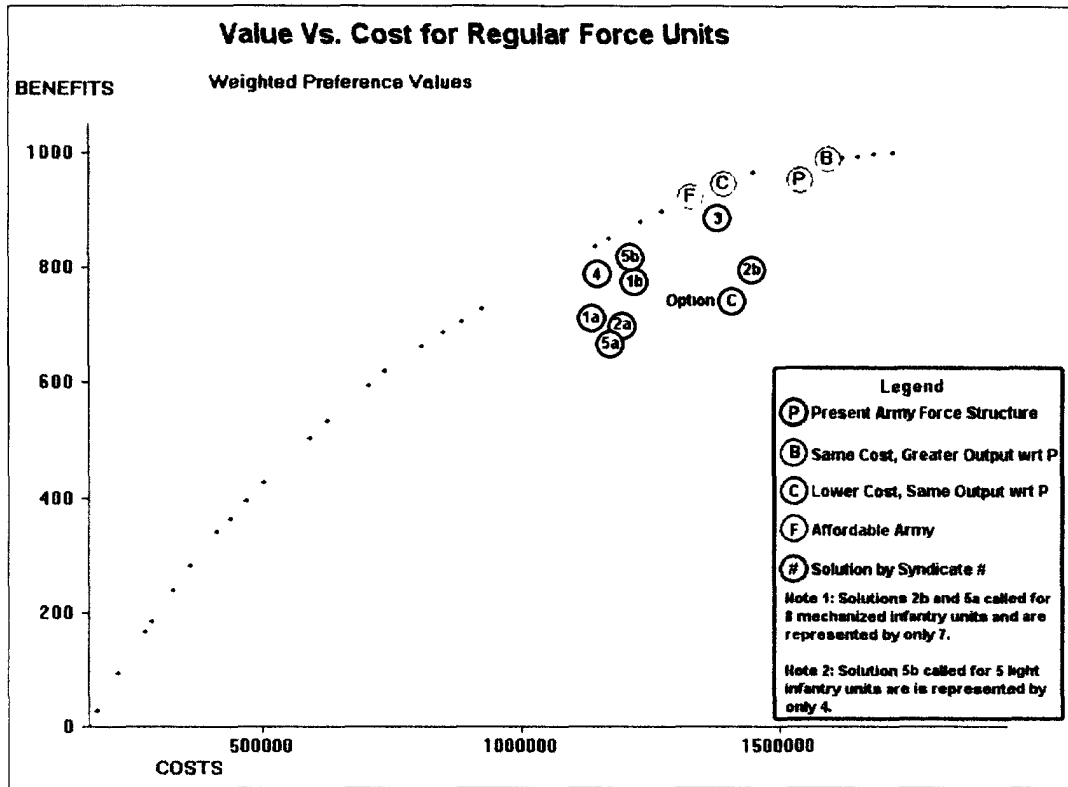


Figure 18 – Value vs. Cost for Regular Force Units (including the Army Transformation Working Group's "Option C").

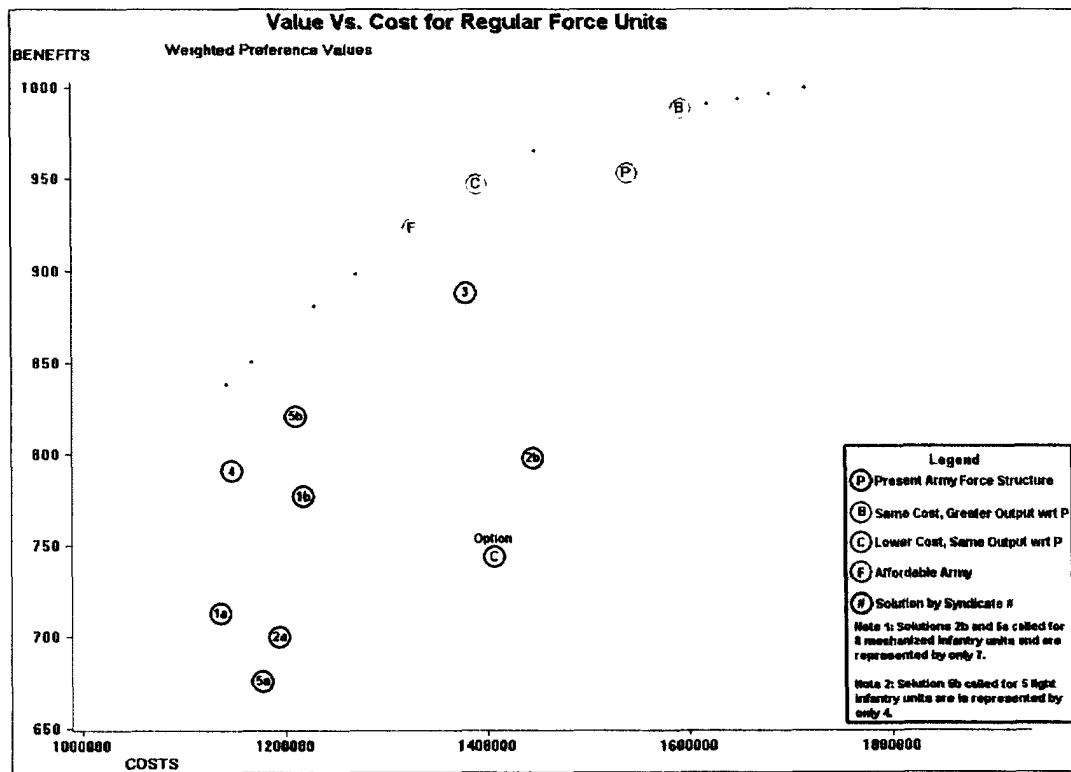


Figure 19 – Same as Figure 18, but zoomed in to relevant areas.

## **6.2 COMMON THEMES**

137. A number of themes were common to most syndicates:

- a. There is wide acceptance that, in theory at least, adoption of a tiered readiness system offers the potential to achieve significant savings without unduly compromising commitments. At the same time there was a sense of unease over implementation, i.e. how it would work in practice.
- b. It was recognised that the differences in force generation structure and force employment structure need to be reconciled. The differing values assigned to Recce and Tank squadrons, and the inclination to migrate some of the Artillery and Armoured functions to the Reserves, are illustrative.
- c. The importance attached to Mechanised Infantry is noteworthy. Many syndicates opted to “buy” additional mechanised units, or to create hybrid partially mechanised units; often this was done at the expense of Light Infantry. Given the relative costs, this presents Army planners with the classic quality versus quantity conundrum.
- d. It is difficult to generalise with respect to Reserves. Perhaps not unexpectedly, the AHP results indicate that it is in terms of Footprint and Mobilisation potential that the Reserves make their prime contribution. Suggestions for increasing their value included further integration into Scenario and Tasking commitments and/or speciality roles, e.g. CIMIC and PSYOPS.
- e. Some syndicates indicated a preference for a two Brigade Group option, however, they recognised the potential political implications and regional sensitivities.

## **6.3 POST-ASX ANALYSIS**

### **6.3.1 EQUITY Results**

138. The key results derived from the EQUITY model have been presented above or are located in Annex E. In order to confirm the stability of the AHP generated

criteria weights, a simplistic sensitivity analysis was performed. This was done by independently doubling and halving the weights assigned to the criteria and redistributing the remaining “weight available” proportionally amongst the other criteria based on the previous relative weightings. The differences in the EQUITY solution with the baseline weights and the new perturbed weights was noted. In the case of the Scenarios criterion, it was not possible to double the weight, so it was increased by 50%. The baseline and perturbed weights are given in Table XVII:

**TABLE XVII**  
**BASELINE AND PERTURBED WEIGHTS**  
**USED IN THE SENSITIVITY ANALYSIS**

	<b>Scenarios</b>	<b>Taskings</b>	<b>Footprint</b>	<b>Mobilisation</b>
Baseline Weights	59	26	8	7
Increase Scenarios Weighting	89	7	2	2
Half Scenarios Weighting	30	44	14	12
Double Taskings Weighting	38	52	5	5
Half Taskings Weighting	69	13	10	8
Double Footprint Weighting	54	24	16	6
Half Footprint Weighting	62	27	4	7
Double Mobilisation Weighting	55	24	7	14
Half Mobilisation Weighting	61	27	8	4

139. The resulting Army force structures that EQUITY generates are given in Table XVIII. The only significant change from the baseline EQUITY solution occurs when the weight of the Scenarios criterion is increased by 50%. At this point, which results in a weight of 89 out of a possible 100, the criteria where the Reserve units obtain their highest scores relative to the Regular Force are marginalised. Consequently, significant decreases are realised in the Infantry and Armoured Mission Elements. This is fully understandable. The other deviations from the baseline scores are small and simply reflect specific areas where certain units scored particularly well or poorly compared to the other capability areas. In sum, the solution set demonstrates a high degree of stability with respect to the weights of the criteria.

TABLE XVIII  
SENSITIVITY ANALYSIS FOR REGULAR AND RESERVE FORCE UNITS

<b>Affordability (\$M)</b>	<b>Pres.</b>	<b>Baseline (EQUITY)</b>	<b>Inc. Scen.</b>	<b>+/-</b>	<b>Half Scen.</b>	<b>+/-</b>	<b>Double Task.</b>	<b>+/-</b>	<b>Half Task.</b>	<b>+/-</b>	<b>Double Ftrprt.</b>	<b>+/-</b>	<b>Half Ftrprt.</b>	<b>+/-</b>	<b>Double Mob.</b>	<b>+/-</b>	<b>Half Mob.</b>	<b>+/-</b>
<b>\$1,764</b>			<b>89</b>		<b>30</b>		<b>52</b>		<b>13</b>		<b>16</b>		<b>4</b>		<b>14</b>		<b>4</b>	
<b>Actual Cost</b>	<b>\$2,058</b>	<b>\$1,751</b>	<b>\$1,792</b>		<b>\$1,846</b>		<b>\$1,809</b>		<b>\$1,767</b>		<b>\$1,751</b>		<b>\$1,751</b>		<b>\$1,751</b>		<b>\$1,751</b>	
<b>Cost Delta</b>	<b>(\$294)</b>	<b>\$13</b>	<b>(\$28)</b>		<b>(\$82)</b>		<b>(\$45)</b>		<b>(\$3)</b>		<b>\$13</b>		<b>\$13</b>		<b>\$13</b>		<b>\$13</b>	
<b>Mech Inf Bn</b>	<b>6</b>	<b>4</b>	<b>4</b>	<b>0</b>	<b>4</b>	<b>0</b>	<b>4</b>	<b>0</b>	<b>4</b>	<b>0</b>	<b>4</b>	<b>0</b>	<b>4</b>	<b>0</b>	<b>4</b>	<b>0</b>	<b>4</b>	<b>0</b>
<b>Light Inf Bn</b>	<b>3</b>	<b>3</b>	<b>4</b>	<b>1</b>	<b>4</b>	<b>1</b>	<b>3</b>	<b>0</b>	<b>4</b>	<b>1</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>0</b>
<b>Res Inf Msn Elm</b>	<b>62</b>	<b>62</b>	<b>46</b>	<b>-16</b>	<b>62</b>	<b>0</b>	<b>62</b>	<b>0</b>	<b>62</b>	<b>0</b>	<b>62</b>	<b>0</b>	<b>62</b>	<b>0</b>	<b>62</b>	<b>0</b>	<b>62</b>	<b>0</b>
<b>Armour Regt</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>
<b>Res Armd Msn Elm</b>	<b>15</b>	<b>15</b>	<b>9</b>	<b>-6</b>	<b>15</b>	<b>0</b>	<b>15</b>	<b>0</b>	<b>15</b>	<b>0</b>	<b>15</b>	<b>0</b>	<b>15</b>	<b>0</b>	<b>15</b>	<b>0</b>	<b>15</b>	<b>0</b>
<b>Res Recce Msn Elm</b>	<b>9</b>	<b>9</b>	<b>9</b>	<b>0</b>	<b>9</b>	<b>0</b>	<b>9</b>	<b>0</b>	<b>9</b>	<b>0</b>	<b>9</b>	<b>0</b>	<b>9</b>	<b>0</b>	<b>9</b>	<b>0</b>	<b>9</b>	<b>0</b>
<b>Arty Regt</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>
<b>Res Arty Msn Elm</b>	<b>21</b>	<b>21</b>	<b>21</b>	<b>0</b>	<b>21</b>	<b>0</b>	<b>21</b>	<b>0</b>	<b>21</b>	<b>0</b>	<b>21</b>	<b>0</b>	<b>21</b>	<b>0</b>	<b>21</b>	<b>0</b>	<b>21</b>	<b>0</b>
<b>LLAD Bty</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>
<b>VSHORAD Bty</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>
<b>Res VSHORAD Bty</b>	<b>4</b>	<b>5</b>	<b>5</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>5</b>	<b>0</b>
<b>Fd Engr Regt</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>0</b>
<b>Res Fd Engr Msn Elm</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>0</b>	<b>12</b>	<b>0</b>	<b>12</b>	<b>0</b>	<b>12</b>	<b>0</b>	<b>12</b>	<b>0</b>	<b>12</b>	<b>0</b>	<b>12</b>	<b>0</b>	<b>12</b>	<b>0</b>
<b>Engr Sp Regt</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>
<b>CS Service Bn</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>0</b>
<b>Res Svc Bn Msn Elm</b>	<b>22</b>	<b>22</b>	<b>22</b>	<b>0</b>	<b>22</b>	<b>0</b>	<b>22</b>	<b>0</b>	<b>22</b>	<b>0</b>	<b>22</b>	<b>0</b>	<b>22</b>	<b>0</b>	<b>22</b>	<b>0</b>	<b>22</b>	<b>0</b>
<b>Comd Sp Bn</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>-1</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>2</b>	<b>-1</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>0</b>

### 6.3.2 SOCRAM Results

140. The detailed SOCRAM analysis took place after the ASX. A risk level and consequence of failure score were calculated separately for each of the syndicate solutions. There is scope for further analysis of the ASX data especially in the area of sensitivity analysis of the syndicate solutions, scenario activation rates, variant response data and other SOCRAM input data. Due to other priorities this analysis has not been performed. Work in this area can be conducted in the future if the Army indicates they have a need for further analysis of the ASX data.

141. Table XVI outlines the force structure options that were used initially to populate SOCRAM. The option set included the present force structure and alternatives generated by EQUITY and the syndicates at the ASX. Note that the force structure elements for the Reserves are not included in this analysis. The scenario weightings used to calculate the consequence of failure score are those that include the likelihood of occurrence shown in Table XII.

142. For each force structure option, a systemic risk, an individual unit risk and consequence of failure score was calculated. This information is summarised in Table XIX. The value and cost of each option are noted in the first two rows of the table.

143. Individual risk in Table XIX is calculated from the fraction of the total number of iterations in which there was a shortfall of that particular unit type in the simulation. The systemic risk is considered as the fraction of iterations in which there was a shortfall of at least one unit type in the simulation. Both of these values are expressed as a percentage. That is, a shortfall occurs when there is not enough of a particular unit type in the pool of available operational assets, represented by the force structure option under consideration, to meet the demands of the scenario variants that were activated in a particular iteration of the SOCRAM simulation.

144. The consequence of failure and the systemic risk scores are accrued upon each iteration in which there was a shortfall of operational assets. However, the difference distinguishing the former is that in the event of a shortfall in a particular iteration, the consequence of failure score will vary in relation to which scenarios the Army was unable to respond to. This is unlike system risk, which increases proportionately for each iteration that activates a greater demand than is available. For each iteration where the operational assets pool fails to satisfy the requirements, the scenario variant with the lowest scenario weighting (Table XVI) is deactivated and the assets it

demanded are made available to the remaining activated scenario variants. If a shortfall in operational assets remains, the process is repeated. Once the pool of operational assets suffices to meet the demands of the activated scenario variants, the process stops for this particular iteration. The consequence of failure score for that iteration reflects the sum of the weightings for the deactivated scenario variants. The resultant consequence of failure score represents the sum of the scores over all the iterations.

**TABLE XIX**  
**CONSEQUENCE OF FAILURE, INDIVIDUAL AND SYSTEMIC RISKS**  
**FOR ASX SYNDICATE FORCE STRUCTURES**

	"P"	"P"	Syn 1a	Syn 1b	Syn 2a	Syn 2b	Syn 3	Syn 4	Syn 5a	Syn 5b	Option "C"
Value	953	923	713	777	700	798	888	791	676	821	744
Cost (\$B)	1.540	1.328	1.136	1.218	1.194	1.519	1.379	1.147	1.250	1.250	1.407
<b>Consequence Score</b>	<b>707</b>	<b>3743</b>	<b>1469</b>	<b>2755</b>	<b>1680</b>	<b>1539</b>	<b>707</b>	<b>4525</b>	<b>1661</b>	<b>4154</b>	<b>1546</b>
<b>Systemic Risk (%)</b>	<b>5.0%</b>	<b>21.7%</b>	<b>9.9%</b>	<b>16.9%</b>	<b>9.8%</b>	<b>15.5%</b>	<b>5.0%</b>	<b>28.6%</b>	<b>15.9%</b>	<b>27.6%</b>	<b>15.5%</b>
<b>Individual Risks for each unit type (generic or specialised)</b>											
Mech Inf Bn (%)	3.3%	21.5%	3.3%	10.1%	3.3%	0.2%	3.3%	21.5%	0.2%	21.5%	0.7%
LLAD Bty (%)	0.0%	0.0%	0.0%	0.0%	0.0%	7.0%	0.0%	7.0%	7.0%	7.0%	7.0%
Any Engr Unit (%)	0.0%	0.0%	0.2%	0.0%	5.3%	0.0%	0.0%	0.0%	0.2%	0.0%	0.2%
Lt Inf Bn (%)	0.0%	0.0%	4.9%	4.9%	4.9%	4.9%	0.0%	0.0%	4.9%	0.0%	4.9%
Any Inf Unit (%)	0.1%	0.0%	2.0%	4.1%	2.0%	0.6%	0.6%	0.0%	0.6%	0.0%	1.1%
MP Pl (%)	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%
Comd Sp Bn (%)	0.0%	0.0%	2.8%	0.0%	2.8%	0.0%	0.0%	0.0%	2.8%	0.0%	0.0%
Any Cbt Unit (%)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.2%	0.1%	0.1%	0.0%
Armd Regt (%)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.1%	0.0%	0.0%	0.0%
Reg EW Sqn (%)	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%
Arty Regt (%)	0.0%	0.0%	0.6%	0.6%	0.0%	0.0%	0.0%	0.6%	0.6%	0.6%	0.0%
Fd Engr Regt (%)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Any Svc Unit (%)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Any Army Unit (%)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CS Svc Bn (%)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
GS Svc Bn (%)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Engr Sp Regt (%)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
VSHORAD Bty (%)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Any AD Bty (%)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

145. The concept of substitution, explained in detail in Chapter 3, results in a number of additional units appearing in Table XIX. If the name of an Army unit

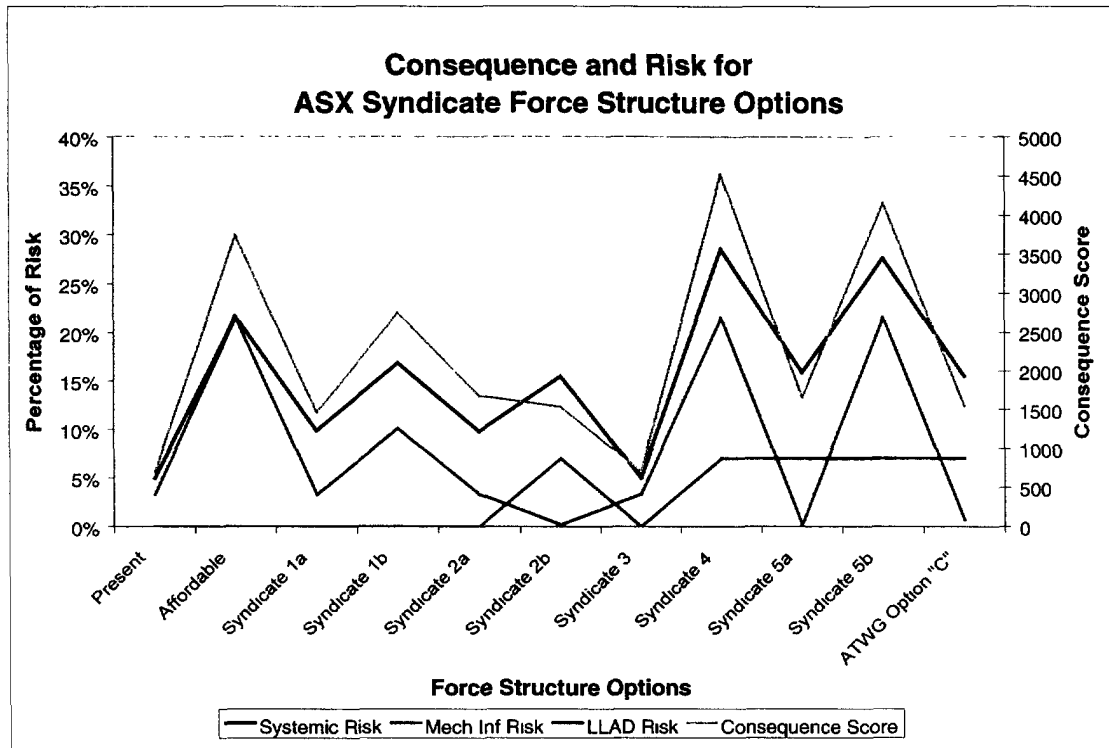
begins with the word "Any", it denotes that this unit can consist of any one of a number of other Army units.

146. The most striking realisation of the SOCRAM results is that the main driver for systemic risk and consequence of failure across the options is the number of mechanised infantry units. Both the largest maximum and average value for risk relates to the availability of mechanised infantry.

147. To investigate this further, a correlation table was constructed. It was determined that mechanised infantry was very highly correlated with both system risk and consequence of failure (0.80 and 0.93 respectively). These figures were much higher than the correlation against individual risk for any other unit type. The next highest correlation value for system risk and consequence of failure score were for LLAD units with scores of 0.60 and 0.58 respectively.

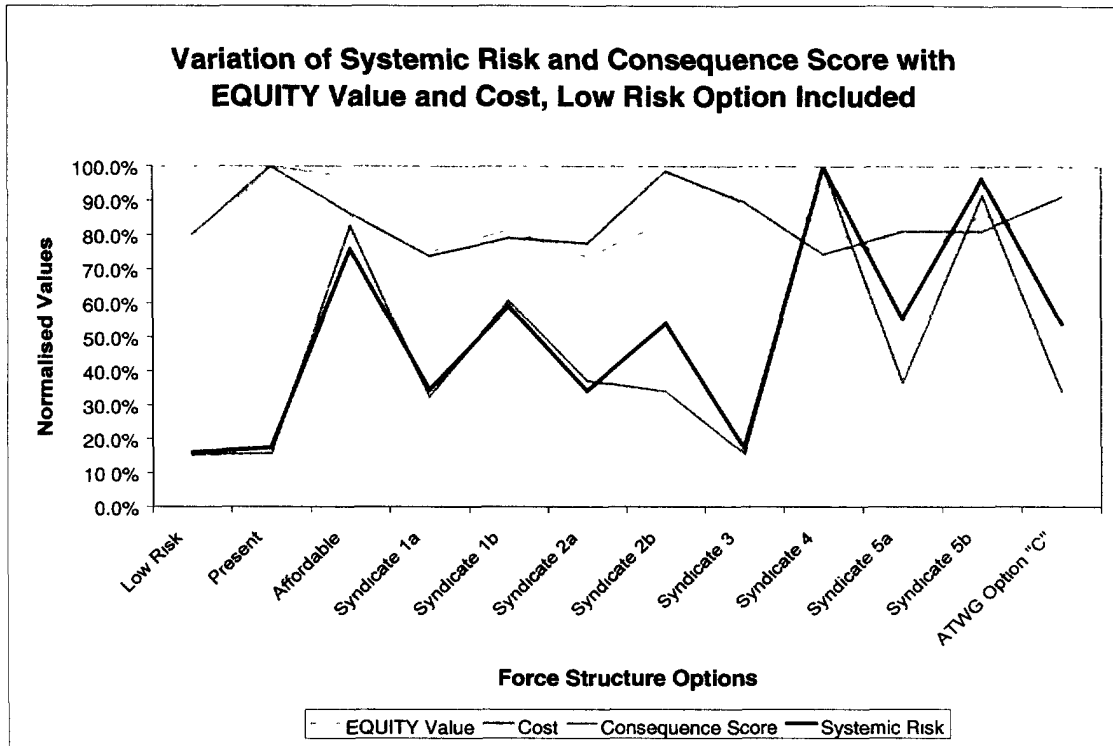
148. Figure 20 illustrates the correlation between system risk, consequence of failure and mechanised infantry individual risk. LLAD units were included in this chart to portray why system risk moves away from mechanised infantry risk for the force structure option 2b. The drastic increase in LLAD risk, in option 2b is attributable to the absence of LLAD units. This increased the systemic risk from a relatively low level in options 2a and 3 despite the decrease in mechanised infantry risk at this point. This area is the only place on the graph where system risk and consequence of failure do not move in a synchronised fashion. At this point, the absence of LLAD units causes the system to fail every time the variant of Scenario 4, which specifically calls for LLAD units, occurs. This, of course, increases the systemic risk but this relative increase is not reflected in the consequence of failure score because Scenario 4 has a weighting of only 4 points, which is the lowest of all 11 FPS.

149. On the basis of systemic risk and consequence of failure only, the best option would appear to be the one developed by Syndicate 3.



**Figure 20 – Systemic risk and consequence of failure for each of the syndicate’s force structures with the primary risk drivers.**

150. The normalised data in Figure 21 illustrates the tradeoffs that exist between cost and value, system risk and consequence of failure. Generally, the more expensive options tend to have a greater value and lower systemic risks and consequence scores. For instance, the present army force structure has the highest cost and value but also has the lowest associated risk. However, the force structure proposed by Syndicate 3 has roughly equivalent risks and consequence, but at a 10% savings. Option 1a represents significant savings if additional risk and consequence of failure are tolerated. Further analysis beyond this is not possible without exploration of the maximum acceptable risk (systemic or individual) or the minimum acceptable value/utility for a possible force structure, that is, development of indifference curves.



**Figure 21 – Trade-offs between high costs and values and systemic risk and consequence of failure.**

151. Through sensitivity analysis, other force structure options can be generated that may prove to be viable and useful alternatives for further study. Purely for the purposes of illustration and comparison, a “Low Risk” force structure has been created and is shown in Table XX. This is presented as the Low Risk option in Figure 21. This option has a risk level similar to that of the Army of Today, with a cost 20% lower. More options could be generated, e.g. cheaper options, heavy or light-weight forces, etc., but if anything, the ASX underscores that military judgement would be required to determine their viability.

**TABLE XX**  
**SAMPLE "LOW RISK" ARMY FORCE STRUCTURE**

	<b>Low Risk Option</b>
Mechanised Infantry	7
Light Infantry	1
Armoured Regiment	2
Artillery Regiment	1
LLAD Bty	1
VSHORAD Bty	0
Field Engineer Regiment	2
Engineer Support Regiment	1
CS Service Battalion	1
Command Support Battalion	3
GS Service Battalion	3
Regular EW Squadron	1
MP Platoon	3
EQUITY Value	734
Cost (\$B)	\$1.237
Systemic Risk	4.6%
Consequence Score	689

## 7. CONCLUSIONS

### 7.1 PROCESS

152. A number of lessons can be taken from the ASX in terms of methodological preparations and conduct:

- a. The dress rehearsal was invaluable and contributed to a number of enhancements. However, ideally syndicate leaders would participate, both to ensure consideration of a wide range of views and to familiarise the leaders with the proposed line of attack and issues likely to be raised. Including them in planning sessions during the ASX proved extremely useful.
- b. Many participants did not fully appreciate how the methodological pieces fit together until well into the ASX. Although one of the initial briefs included an explanation of the process; in hindsight, it would have been worthwhile including a brief written description in a pre-reading package or with the administrative order.
- c. The costing model was crucial and efforts to develop it beforehand were prudent as time constraints allowed only for “operator” review and refinement. Allowing time and arranging capacity for this was integral to soliciting “buy-in”.
- d. Criteria were also decided beforehand – again a concession to the time constraints. If possible these should have been agreed upon *in situ* and the consensus building exercise would have been useful. More importantly this would have contributed to developing familiarity and a shared understanding of the criteria.
- e. Some of the mission elements chosen for evaluation (i.e. Command Support Battalion and Engineering Support Battalions) reflected concepts that those on the NDHQ staff were familiar with, but many participants were not. In hindsight more time might have been

devoted to expanding on these ideas during the first few days of the ASX. Further, perhaps more use should be made of other means to table proposals and foster dialogue, e.g. an article in a military or army journal.

- f. The program may have been overly ambitious. Participants found it difficult to assess mission element types, quantities and readiness posture trade-offs in one go.

153. The tool set worked well and, in general proved complementary. In particular:

- a. The scenario set was extremely useful in establishing a common contextual setting, but could be enhanced. Variants should be formally reviewed, approved and promulgated. This should include re-titling in those (few) cases where the variant description situated the operational response. Scenario 10 needs to be subjected to further study, ideally war gaming and/or detailed contingency planning. Defence of Canada is problematic given extant resource constraints and the challenge. Vital point protection requirements are ill defined. Finally the stated obligation to deploy a small force to assist in US operations to restore stability in the affected region of the Americas proved to be more of a distraction than an aide in determining an appropriate response.
- b. AHP worked well as a means to establish relative preferences. The theory was easy to grasp and employ if the number of options to be ranked was limited. Manually inputting the data was tedious, but once entered, the results were available promptly. Several accounts have been published detailing the shortcomings and indeed the invalidity of the AHP including [17], [18] and particularly [19]. However, due to the lack of sensitivity of the optimal force structure packages to the criteria weighting (discussed in §5.2), and the approval of the ASX participants of the weightings produced, the authors believe that in this context, the application of the AHP is justified.
- c. The development of an Activity-Based Costing model for both the Regular and Reserve Forces proved to be challenging, however, this tool has the potential to be of great benefit to the Army. The costing model had an appropriate level of fidelity and should continue to be

developed and maintained to allow force structure option exploration to continue.

- d. The EQUITY model was found to be very relevant and useful for such activities, if the limitations of the tool are acknowledged and understood. EQUITY's formulation of "optimal" solutions is based purely on its mathematical algorithms. Given "perfect" inputs (in this case, unit value assessments), EQUITY would generate a definitive output (i.e., a viable and reasonable Army force structure). However, since it is extremely difficult for individuals to compare options objectively and assign a score to a capability area that reflects precisely their assessment, the EQUITY solution will inevitably be notional and the results will require interpretation. As always with such decision support computer models, it is necessary for the "experts" to evaluate the outputs and determine if they make sense in the real world. Still, that being said, the use of EQUITY did contribute to bring many of the key issues to the fore and helped to facilitate and focus the plenary discussion on the key issues.
- e. The ASX raised several issues related to SOCRAM.
  - (1) The SOCRAM methodology is flexible within limits and the rate of change of the environment to be modelled made it difficult for SOCRAM to keep pace. In the future more effort should be made to refine and freeze the modelling environment before an exercise of this type. (It is understood that this is not always possible.)
  - (2) The ASX participants had the necessary knowledge required to provide the SOCRAM inputs, but the production of valid input data requires a new perspective. At the ASX, the operational demand data generated by the syndicates seemed to be based on the existing force structure. Ideally, the current inventory would be ignored and responses should be based solely on mission requirements. Providing a fuller description of the data requirements for SOCRAM and allowing more time for discussion might have mitigated this impasse.

- (3) Lastly, it is important that the SOCRAM input data providers have a common understanding of what each variant's mission entails. The assumptions of the mission requirements varied between the syndicates and responses to the same variant differed widely. A more detailed description and subsequent discussion of the variants might have solved this problem.

## 7.2 THE WAY AHEAD

154. Many of the observations augur for a programmed series of restructuring exercises rather than the current *ad hoc* approach. A phased approach would allow greater fidelity and promote dialogue and buy-in. Ideally, the set of criteria would be developed by the ASX participants. Follow-on work from this ASX includes collective analysis and interpretation of the results.

155. While the ASX was constrained to seek possible solutions that would be achievable by the year 2004, it is recommended that a capability based planning approach be used where possible for similar activities (e.g. Army of Tomorrow or Future Army). This would more readily permit a cross-boundary investigation of options.

156. The SOCRAM model is continuously evolving. Currently the substitution and consequence of failure concepts are being adjusted to cater for the general situation. At the ASX these features were designed specifically for the Army case. A SOCRAM model is being developed which will provide a risk assessment for the CF as a whole. This work is being conducted for the Defence Services Program Update.

157. The wide range in the desired responses to scenario variants for SOCRAM that were generated by the syndicates indicate that war gaming and development of detailed contingency plans could assist in providing more accurate inputs to SOCRAM.

158. Finally, complimentary models should be developed if SOCRAM is adopted CF-wide. That is, OR tool sets which will explore the related Force Generation and overhead costs associated with the operational demand results SOCRAM produces.

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ANNEX A  
ORD PROJECT REPORT PR 2001/21  
NOVEMBER 2001

### **Introductory Presentations Given at the Army Sustainability Exercise**

The first day of the Army Sustainability Exercise (ASX) consisted primarily of briefings given to the exercise participants. This process was intended to bring all present to a common base level of knowledge and increase their appreciation for the challenges facing the Army. These presentations, included as Appendices, are:

- a. Appendix 1 – Army Sustainability Exercise by MGen Dempster, Assistant Chief of the Land Staff;
- b. Appendix 2 – ASX Performance Report Presentation by Maj Leclaire, Director Land Strategic Planning 4-3;
- c. Appendix 3 – The Tasks and Resources Report by LCol Gunn, Director Land Strategic Planning 4;
- d. Appendix 4 – Development Report (Emerging Strategic Plan) by Col Peters, Director Land Strategic Planning;
- e. Appendix 5 – Future Army Conceptual Framework by LCol Ap Probert, Directorate Land Strategic Change;
- f. Appendix 6 – ASX Model by LCol Gunn, Director Land Strategic Planning 4 and Mr. Offiong, Land Forces Operation Research Team 6;
- g. Appendix 7 – Creating a Managed-Readiness System: The Army Training & Operations Framework (ATOF) by Maj Hope, Land Forces Doctrine and Training System; and
- h. Appendix 8 – ASX Costing Model by Maj Bouffard, Army Comptroller.

APPENDIX 1  
ANNEX A  
ORD PROJECT REPORT PR 2001/21  
NOVEMBER 2001

**ARMY SUSTAINABILITY EXERCISE**

**Presentation Intent**

- To Introduce
- To Stimulate
- To Challenge
- To Provoke
- To Engage
- 
- 
- 

Major General Doug Dempster  
Assistant Chief of the Land Staff

- "The notion of strategy implies an organized authority capable of sustained action along lines of policy"  
Paul H. Nitze, Address to USA WC, 1958
- "In Chinese, the ideogram for *crisis* is a combination of the characters for *danger* and *opportunity*"  
Evan Dudik, 2000
- "Let all things be done decently and in order"  
I Corinthians, XIV, 40

- "One should never risk one's whole fortune unless supported by one's entire forces"  
Machiavelli 1531
- "I see quantification as a language to add precision to reasoning about the world"  
Robert McNamara 1995
- "The great thing about an Army officer is that he does what you tell him to do"  
Theodore Roosevelt 1858-1919

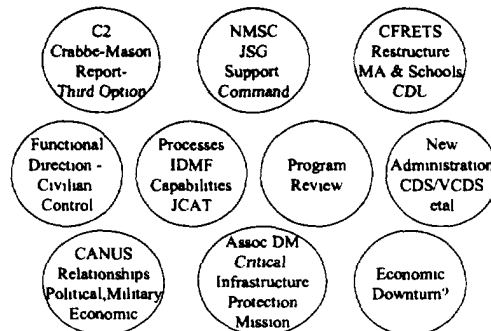
**AIM & OBJECTIVES OF ASX**

- to identify an optimum, balanced mix of structure and activities obtainable within allocated resource levels,
- if the structure and activities identified above do not meet the requirements of present tasks, to identify those additional resources necessary to meet those tasks while achieving sustainability, and
- to identify the principal constraints which will restrict movement from the status quo to a balanced posture and rough options to deal with those impediments

**PRESENTATION OUTLINE**

- Contexte

**THE TEN DND CORPORATE ISSUES**



**PRESENTATION OUTLINE**

- Contexte
- Problème de maintien en puissance
- Survol de la méthodologie
- Facteurs clé du succès
- Concept d'exécution

**PROBLÈME DE MAINTIEN EN PUISSANCE**

- Décisions
  - 1993 Établissement
  - 1997 Plan d'urgence
  - 2000 Recrutement
  - 2001 Balance

**METHODOLOGY OVERVIEW**

- Quantitative assessment of value outputs for cost inputs
- Informed professional judgement disciplined through economic and operations research tools
- Major parameters - operational effectiveness, readiness, costs
- Major tools - Equity, SOCRAM, Scenarios, ABC
- Individual, syndicate and plenary interaction
- Lineage of use
  - Naval MBX 1999
  - Air Force FSX 2000

**PERCEPTIONS, BIASES AND THE GROUND TRUTH****Fact or Fiction?**

"We do fire and movement"

**Reality**

Operational experience

- FRY
- Haiti
- Ice storm

Defence scenarios  
Information/C4ISTAR  
Logistics/CSS  
Future army functions

**CAPABILITIES**

**PERCEPTIONS, BIASES AND THE GROUND TRUTH****Fact or Fiction?**

"My kitbag is packed and ready to go"

**Reality**

IRF(L) and domestic operations  
PSO/TMST  
Mobilization  
QOL  
New equipment and doctrine introduction  
Complementary skills  
Cost of readiness

**READINESS**

**PERCEPTIONS, BIASES AND THE GROUND TRUTH****Fait ou Fiction?**

"Supr  matie des op  rations"

**R  alit  **

Tempo des op  rations  
Tempo du personnel  
Changement de tempo  
D  veloppement du combat  
Experimentation  
Conscience de la situation  
  ducation professionnelle militaire

**CONNAISSANCE**

**PERCEPTIONS, BIASES AND THE GROUND TRUTH****Fait ou Fiction?**

"Notre produit est le groupement tactique"

**R  alit  **

Op PALLADIUM  
Op  rations domestiques des ann  es 90  
Timor Oriental,   trier  
Sierra Leone  
Doctrine et technologie

**  CHELLE MOBILE**

**PERCEPTIONS, BIASES AND THE GROUND TRUTH****Fait ou Fiction?**

"La force de r  serve est plus abordable que la force r  guli  re"

**R  alit  **

  quipement et salaire de la r  serve  
Valeur de l'emploi civil  
Utilit    
Pertinence  
Qualit    
Sc  narios

**CO  TS & VALEUR**

**THE ARMY SUSTAINABILITY EXERCISE****Parameters**

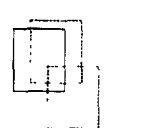
Capability  
Readiness  
Knowledge  
Scalability  
Cost

**Output**

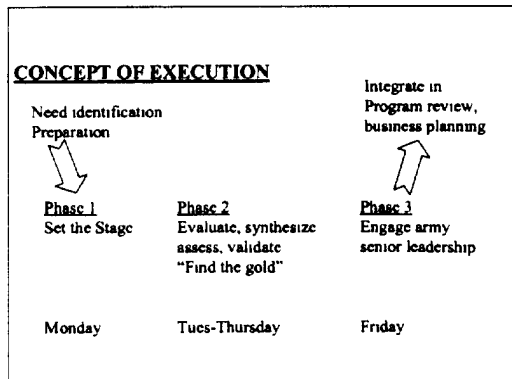
Core  
Value  
Proposition


**Outcome**

Defence policy and  
program options


**KEY SUCCESS FACTORS**

- Diversity of background
- Blend of substance and process
- Knowledgeable subject matter experts
- Comprehensive, high fidelity information base
- Commitment to full participation
- Socratic dialogue & critical thinking
- Timely, iterative analytic feed back



APPENDIX 2  
ANNEX A  
ORD PROJECT REPORT PR 2001/21  
NOVEMBER 2001

ASX PERFORMANCE REPORT PRESENTATION

1. The performance report will be briefed using the Performance Measurement software PB Views. It will not use PowerPoint slides. The following table describes the measures that will be covered as well as a quick summary for each briefing subject.
2. It should be noted that much of the latest data has not yet reached this HQ. The latest set of data will be inputted in the new system going online. We did not have the resources to maintain the pilot database updated. DLSP will be in a better position to brief using the latest set of data in a few weeks from now.

Measurement Area	Measures	Summary
<b>Force Generation</b>		
Generation	Pers Strength	New measure. Pers readiness classified report will be kept by DLFR.
	Eqpt Serviceability	No major problems
	Training Level	Generally achieved as per directions
Sustainability		Under development by DLFR
Capability	Eqpt Suitability	Substantial improvement due to new eqpt and to the change in standard (lighter forces in mid intensity)
	Eqpt Modernization	Not measured yet. Under development in DLR.
	Interoperability	Not measured yet. Under development in LFDTS/DAD
<b>The Army Team</b>		
Well-Being	Retention	7% lower than CF averages. Historically consistent but has never been addressed. This measure will soon be complemented by looking at releases.
	Confidence in Leadership	High level of confidence in leadership at all levels of the Field Force
	Cohesion & Morale	Much higher than expected
	Professional Morale	Good
Work Environment	Harassment Complaints	High numbers due to new understanding of harassment. Will be used as a baseline. Need to establish a reduction target.
	Bilingualism	Very low. Measure being adjusted to be more focused.
	General Safety	New indicator. Data collection to begin this year
	Representation	% of women in the workforce well below population and below CF average. No data available for minorities. Planned to commence in Sept 01.
	Trg Programs	Constantly changing. May be required to report on but unlikely to drive any action. This measure should be reviewed (updated if it is worthwhile) or eliminated.

Measurement Area	Measures	Summary
Learning Environment	Education	Officer education level below intended targets. Current strategy will only solve the issue in the time required to go thru a full generation of officers. If this is not acceptable, a new strategy needs to be put in place and funded.
Members' Identity	Ideology & Ethos	The new generation of soldiers does not share some of the values promoted by the institution. Their assessment of the worthiness of a long term career is low.
<b>Resource Management</b>		
Budget Mgt	Expenditures	No data available yet
Realty Mgt	Suitability	Infrastructure suitable to support the mission
	Condition	Infrastructure was mortgaged in the past few years and required caution.
	Compliance	Infrastructure generally compliant to regulations with one notable exception in CTC Gagetown.
	Infra Expenditures	New indicator. Data collection to start this year
Environment Mgt	Warnings	Good. No warnings in the last year
	Pollution prevention Prg	Ongoing. Adjustments to the collection plan to begin this year. Previous data was not suitable to provide good indication of performance.
	Contaminated Site Mgt	Effective mgt program in place.
<b>Support to Govt</b>		
Post Op Eval	C2	Warning phase of any operation (controlled by DCDS) is the main source of concerns
	Personnel	No issues
	Training	No issues
	Conduct of Ops	No issues
	Eqpt Effectiveness	Some shortfalls in AVGP veh performance. Replacement by Coyote has addressed this shortfall.
<b>Image</b>	External Image	Measured by proxy. Good results with a minor decline from 85% to 81% in the last 3 years

APPENDIX 3  
ANNEX A  
ORD PROJECT REPORT PR 2001/21  
NOVEMBER 2001

THE TASKS AND  
RESOURCES REPORT

(Presented by  
LCol R.D. Gunn, DLSP 4)

SUMMARY

- Task and resource related impetus for strategic level change to the Army; and
- the Departmentally defined limits to the Army's near term strategic freedom of action

TASKS  
RESOURCES

TASKS  
HISTORICAL PERSPECTIVE

TASKS - FLEXIBILITY

- General Purpose vs. Multi-Purpose
- Capability-Based vs. Commitment-Based Planning
- CF Force Structuring

TASKS - ASSIGNED & IMPLIED

- Sustaining agenda
- Change agenda

TASKS  
SUSTAINING AGENDA

TASKS - STRUCTURE

- Force structure-related tasks:
  - IRU per LFA;
  - Bde Gp + Bn Gp (not sustained) or BG + Bn Gp (sustained indefinitely);
  - Bde Gp for operations in N America
  - ability to expand over time

TASKS - RISK

- Assessment
- Acceptable level?
- Change = Risk
- No Change = Risk

TASKS - TEMPO

- The problem
- The reason
- The solution

TASKS

CHANGE AGENDA

Army Goals in Support of Defence Plan 2001  
CHANGE OBJECTIVES

- Change Objective #3 - Modernize
  - Implement a transition plan to achieve a sustainable intermediate Army of Tomorrow structure for the year 2005, emphasizing medium weight, mechanized forces with enhanced command, support and ISTAR capability
  - Harmonize the approved LFRR Strategic Plan with the modernization of the Regular component

TASKS

LOOKING AHEAD

TASKS -  
CHALLENGES/OPPORTUNITIES

- Capability (quality) gap
- Capability (quantity) delta
- High tempo
- Reserve Force

RESOURCES

HISTORICAL PERSPECTIVE

RESOURCES - HISTORY

- Past initiatives

### ORIGINS OF THE DEFICIT

- DER/PER/DPG
  - INFRASTRUCTURE
  - SWE
  - OP ENHANCEMENTS
  - CFSME
  - PRI RESERVE
  - INFLATION
  - DPG 2000
- INFRASTRUCTURE/MAINT
  - DEFERRED
  - GEN MAINT
- ADDITIONAL SP
  - CFRETS
  - IT SYSTEM SP
  - CADETS
- DEVOLVED PROGRAMMES
  - MRs
- UNFUNDED NEW DEMANDS
- NEW LEC INITIATIVES

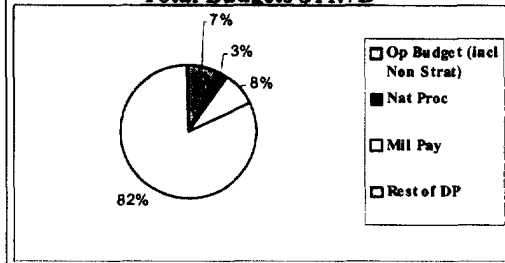
### RESOURCES - CURRENT SITUATION

- Current annual deficit
- Stop-gaps

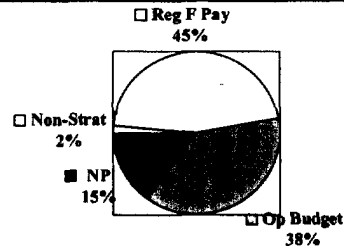
### RESOURCES - STOP-GAP REDUCTIONS

MR, Non strat cap	91M	} 68%
Facil recap, MNC	44M	
Primary Res program	10M	
Asst CLS reserve	17M	
IT, SWE, pers & admin sp	9M	
BG trg	7M	
Other	16M	

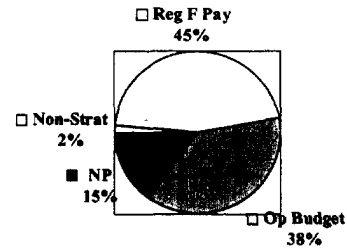
### FY 01-02 DP 2001 Total Budgets \$11.7B



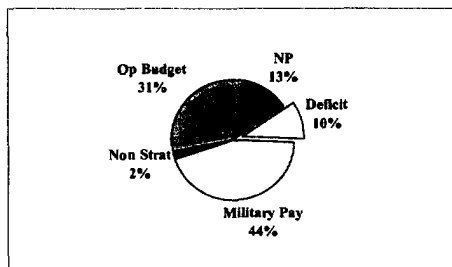
### FY 01-02 Total Budget (\$1,925M)



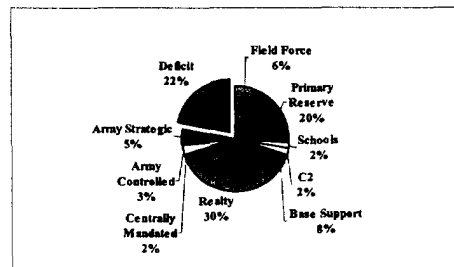
### FY 01-02 Total Budget + Deficit (\$1,925M + \$130M)



### CHART 2 FY 00-01 Total Budget+Deficit (1,848M+199M=\$2,047M)



### CHART 4 Op Budget Detail (\$694M + \$199M)



### RESOURCES - COST PER SOLDIER

$$\frac{\$199M}{\$43K/PY} = 4,730 \text{ PYs}$$

$$\begin{aligned} \$199/2 &= 2365PY \\ \$199/2, \$43K \times 2 &= 1183PY \end{aligned}$$

### RESOURCES - LOOKING AHEAD

- New reqrs?
  - Environmental issues
- NP
- Modernization

### RESOURCES - CHALLENGES/OPPORTUNITIES

- Deficit
- Debt
- Control of budgets

### SUMMARY

- Task and resource related impetus for strategic level change to the Army; and
- the Departmentally defined limits to the Army's near term strategic freedom of action.

### SUMMARY

- **Directed Change:**
  - The DPG Change Objectives
    - #3 Modernize
      - Transition the Army
      - Medium-intensity capability
      - Future parachute capability
    - #4 Globally Deployable
      - Land force deployability
      - Develop NLU's

### SUMMARY

- **Non-Directed Impetus For Change:**
  - Debt (\$289M)
  - Deficit (\$199M/yr)
  - High tempo
  - Capability gap (force quality)

### SUMMARY

- **Strategic Freedom of Action - Limitations**
  - Departmental decision making process
  - Relative size of budgets/deficit
  - Inertia
  - Concurrent Departmental initiatives

### SUMMARY

- **Strategic Freedom of Action - Opportunities**
  - Modernization
  - Tempo reduction/activity synchronization
  - LFRR

## CONCLUSION

## SUMMARY - TASKS AND RESOURCES REPORT

- Directed Change
  - The DP Change Objectives
- Non-Directed Impetus For Change
  - Deficit
  - Tempo
  - Capability gap (force quality)
- Strategic Freedom of Action - Limitations
  - Departmental decision making process
  - Relative size of budget/deficit
  - Inertia
  - Concurrent Departmental initiatives
- Strategic Freedom of Action - Opportunities
  - Modernization
  - Tempo reduction/ activity synchronization
  - LFRK

APPENDIX 4  
ANNEX A  
ORD PROJECT REPORT PR 2001/21  
NOVEMBER 2001

### Le rapport de développement

Presentation to the Army  
Sustainability Exercise

2 April 2001

Col W.N. Peters  
DLSP



### Aim/But

- To provide a wider context for the ASX by describing strategic issues and existing force development activities
- Fournir le contexte nécessaire à l'ESA par la description des questions stratégiques et des activités reliées au développement de la force



### Outline/Agenda

- Army Strategy - La stratégie de l'Armée
- Combat Development - Développement de la capacité
- Key Land Staff Initiatives - Initiatives clés de l'EMAT



### Army Strategy

#### La stratégie de l'Armée



### Background

- ASOR 97
- LFSDG 98
- LFSDG 01



### The Current Strategic Framework: Status Report

Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective
04 Prepare for the Future	Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective
05 Modernized, Sustainable, Combat Capability	Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective
06 Short-Term Sustainability	Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective
07 Unity	Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective	Strategic Objective Priority Objective



### The Departmental Context: Strategy 2020 Change Objectives

- Innovative Path
- Decisive Leaders
- Modernize
- Globally Deployable
- Inter-operable
- Career of Choice
- Strategic Partnerships
- Effective Resource Stewardship



### Le contexte départemental: objectifs de changement pour 2020

- Innovation
- Leaders décisifs
- Moderniser
- Déployable partout dans le monde
- Interopérabilité
- Carrière de choix
- Partenariat stratégique
- Gestion efficace des ressources



### **The Army Strategic Refocus - CLS Guidance**

- Strategic Analysis - gaining the initiative
- Tenets:
  - Mission Focus
  - Effective Command
  - Trust
  - Resource Flexibility
- Themes - Unity, Sustainability and Capability



### **Révision stratégique de l'Armée - Direction du CEMAT**

- Analyse stratégique - prendre l'initiative
- Principes:
  - Se concentrer sur la mission
  - Commandement efficace
  - Confiance
  - Flexibilité des ressources
- Thèmes: unité, soutenabilité et capacité



### **The Army Vision**

"The Army will generate, employ and sustain strategically relevant and tactically decisive medium-weight forces. Using progressive doctrine, realistic training and leading-edge technologies, the Army will be a knowledge-based and command-centric institution capable of continuous adaptation and task tailoring across the spectrum of conflict. The cohesion and morale of our soldiers will be preserved through sharing a collective covenant of trust and common understanding of explicit and implicit intent. . .



### **The Army Vision**

... With selfless leadership and coherent management, the Army will achieve unity of effort and resource equilibrium. The Army will synchronize force development to achieve joint integration and combined interoperability with the ground forces of the United States, other ABCA countries and selected NATO allies. As a broadly-based representative national institution with a proud heritage, the Army will provide a disciplined force of last resort and contribute to national values and objectives at home and abroad."



### **Army Change Objective Defence Plan 01**

**Transition the Army.** Implement a transition plan to achieve a sustainable Army of Tomorrow structure for the year 2005, emphasizing medium weight, mechanized forces with enhanced command support and ISTAR capability, which will lead to a more strategically useful Army. This will lay the groundwork for more fundamental Army Transformation in the Future Army (beyond 2011). It will also harmonize the approved LFRR Strategic Plan with the modernization of the Regular component.



### **Proposed Army Strategic Objectives**

1. Connect with Canadians
2. Shape army culture
3. Deliver a combat-capable, sustainable future force structure
4. Manage readiness



### **Objectifs stratégiques proposés par/pour l'Armée**

1. Se lier aux canadiens
2. Façonner la culture de l'Armée
3. Livrer une structure de la force capable de combattre et soutenable
4. Gérer la disponibilité opérationnelle



### **1. Connect with Canadians**

- create an open, outward-looking Army environment that seeks opportunities to communicate its successes and failures and actively engages the public in meaningful dialogue
- improve strategic partnering (joint, combined and others such as OGDs, industry and academe)
- build the reputation of the Army as a national institution, understood and embraced by Canadians



### 1. Se lier aux canadiens

- créer pour l'armée un environnement ouvert et extroverti qui facilite la communication des succès et des échecs et permet d'engager le public dans un dialogue significatif
- améliorer le partenariat stratégique (interarmée, combiné et autres, comme les autres ministères, l'industrie et l'académie)
- bâtir la réputation de l'Armée comme institution nationale, comprise et adoptée par les canadiens



### 2. Shape Army Culture

- nurture a strong Army, war-fighting ethos that supports effective command
- build mutual trust through predictability and transparency
- capitalize on diversity by improving cultural awareness and linguistic skills
- institutionalize life-long learning, openness to self-criticism and future focus
- create a challenging environment that assists in the attraction and retention of the right kind of personnel



### 3. Deliver a Combat-Capable, Sustainable Future Force Structure

- build on an efficient resource balance among all organizational components of the Army
- achieve a transformed information-age Army - an agile, lethal, survivable medium-weight force
- fully align regular and reserve capabilities
- improve capability at the brigade group level, including interoperability with US Army divisions, corps or task forces



### 4. Manage Readiness

- produce interoperable, agile, cohesive units efficiently, while maintaining the capacity to sustain deployed forces and generate more forces through mobilization
- develop a cyclical managed readiness cycle that focusses effort, manages OPTEMPO and spreads the tasking burden
- capitalize on improved CF deployment resources to improve Army strategic utility



### Alignment of Army Strategic Objectives and Strategy 2020

1. Connect with Canadians (Strategic Partnerships)
2. Shape army culture - (Decisive Leaders and Career of Choice)
3. Field a combat-capable, sustainable future force structure - (Modernize, Interoperable and Effective Resource Stewardship)
4. Manage readiness - (Globally Deployable)



### The Way Ahead

- Present Army Strategy (2nd Draft) at SPS#4 (26-27 Apr)
- Operationalize the strategy through a follow-on campaign plan, SORD 02 and the LSOP
- Periodically review the success of the strategy, assisted by appropriate performance measures



### Combat Development

#### Développement de la capacité



### Combat Development

- What is it?
  - The process by which we conceive, design and build combat capability



### Combat Development

- **How do we do it?**
  - CD Board
  - the combat function audits
  - other ad hoc working groups as required



### Combat Development

- **Where are we in the process?**
  - Two CD Board meetings
  - CD Issues list
  - Firepower audit partially completed
  - Remaining audits 8-10 May (tentative)



### Combat Development and CF Capability-Based Planning

- Tools - Canadian Joint Task List (CJTL) and Force Planning Scenarios (FPS) Decision Support (SOCRAM, FIDO)
- Capability Goals Matrix



### CF Capability Goals Matrix

Level	Command & Control		Operations			Sustain	Generate	Corp Policy & Strategy
	Command	Info & Intel	Conduct	Mobility	Protect			
Primary Strategic	H		L			L		H
Operational (Domestic)		H			M	M	M	
Operational (Int'l)	M	M	L		L	M		M
Tactical		M				M	M	

The Capability Goals Matrix describes broadly what level of capability is desired by CF leadership.



### Combat Development and CF Capability-Based Planning

- Tools - Canadian Joint Task List (CJTL) and Force Planning Scenarios (FPS) Decision Support (SOCRAM, FIDO)
- Capability Goals Matrix
- **Management Structure (JCRB and JCATs)**

**Deduction** The Army must further refine and align its processes to emerging CF processes



### Key Land Staff Initiatives

#### Initiatives clés de l'EMAT



### Some Key Land Staff Initiatives

- Army Transformation
- Army Training and Readiness Framework
- LFRR
- Mobilization Planning
- Equipment - TCCCS, LAV III, LF C2IS, ISTAR, MIFS etc
- NP and MR Strategies
- Realty Asset Strategy
- Implement ERP
- Implement LFDTs
- Canadian Manoeuvre Training Centre
- Army Culture Project
- CSS Core Restructure
- Employment Equity Initiatives
- Site Support Services Review



### A Shifting Environment: Ten Important DND Issues

- C2 - Crabbe-Mason Report
- NMSC, JSG, Support Command
- CFRETS Restructure
- IDMF, Capability-Based Planning
- Functional Direction, Civilian Control
- CANUS relationships
- Critical Infrastructure Protection
- New CF leadership
- Program Review
- Economic Downturn?



### **Summary**

- **Strategy** - revised, published by mid-May
- **Combat Development** - maturing
- **Staff Initiatives** - requirement for close co-ordination in a shifting environment



### **Questions?**



APPENDIX 5  
ANNEX A  
ORD PROJECT REPORT PR 2001/21  
NOVEMBER 2001

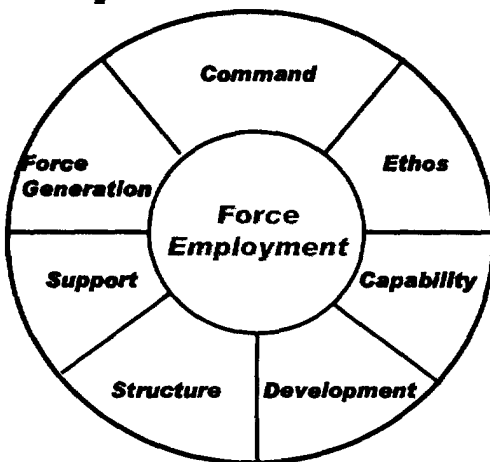
## ***Future Army Conceptual Framework***



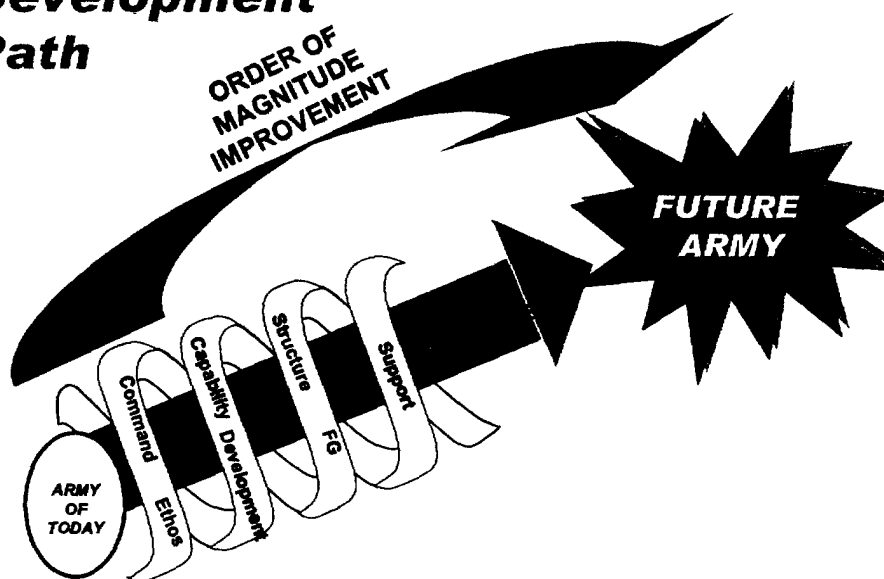
### ***Scope***

- Conceptual Framework
- Missions
- Focus of Concept Development & Experimentation (CDE)
- Future Army Model
- Experiment
- June Army Council

## **The Army Conceptual Framework**



## **The Concept Development Path**



## Army Council Direction

### Probable missions for the Future Army:

#### Primary Mission

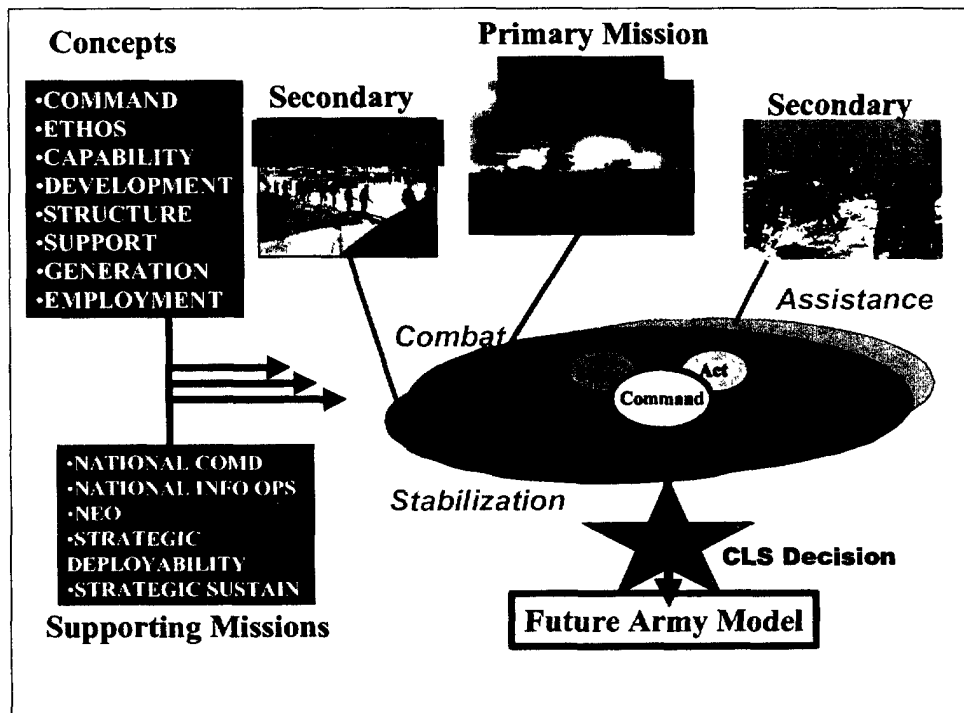
- Combat Operations

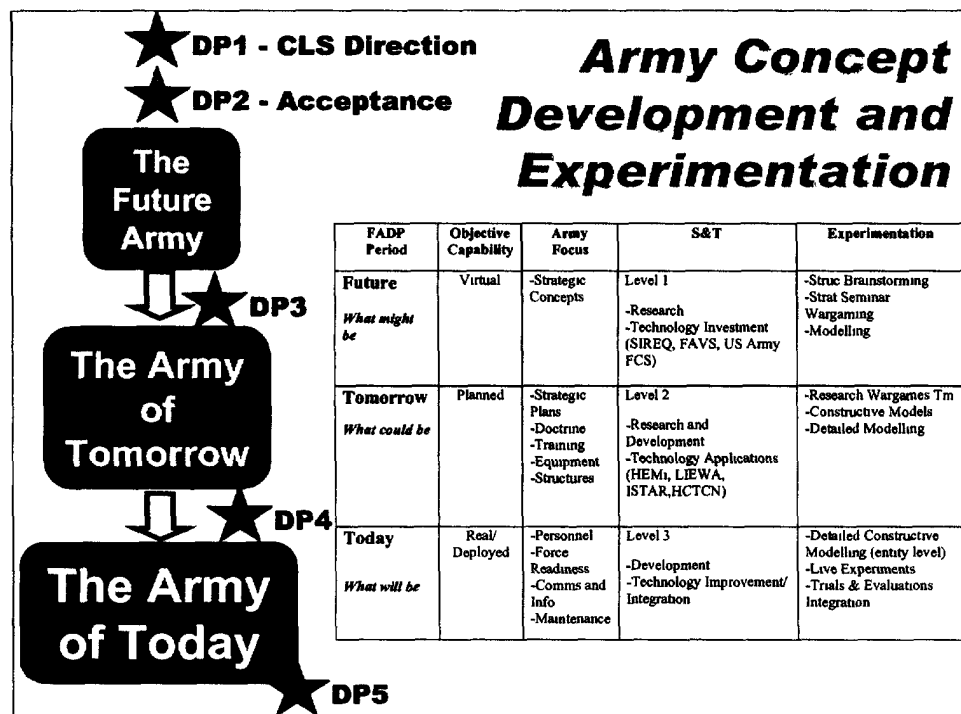
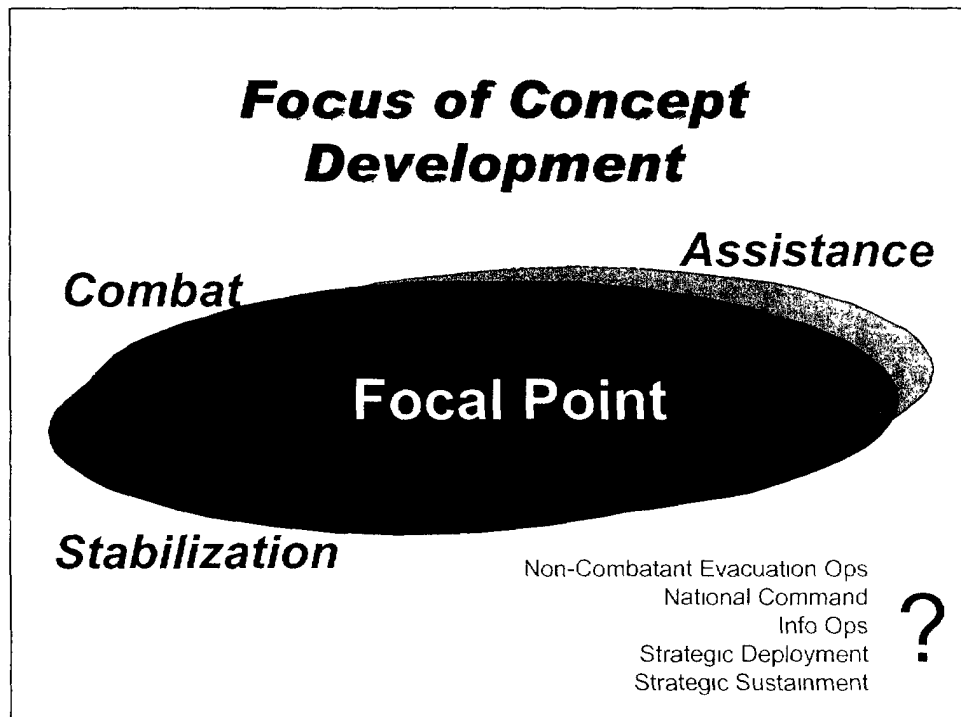
#### Secondary Mission

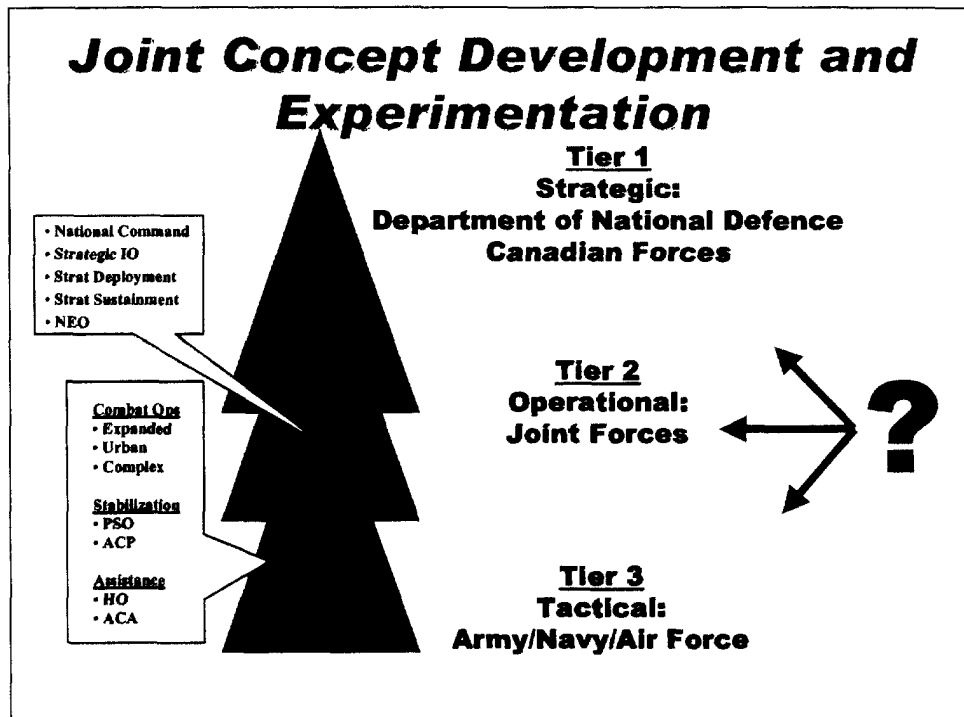
- Stabilization Operations
- Assistance Operations

#### Supporting Missions

- National Command
- Evacuation Operations
- Information Operations
- Strategic Deployment
- Strategic Sustainment



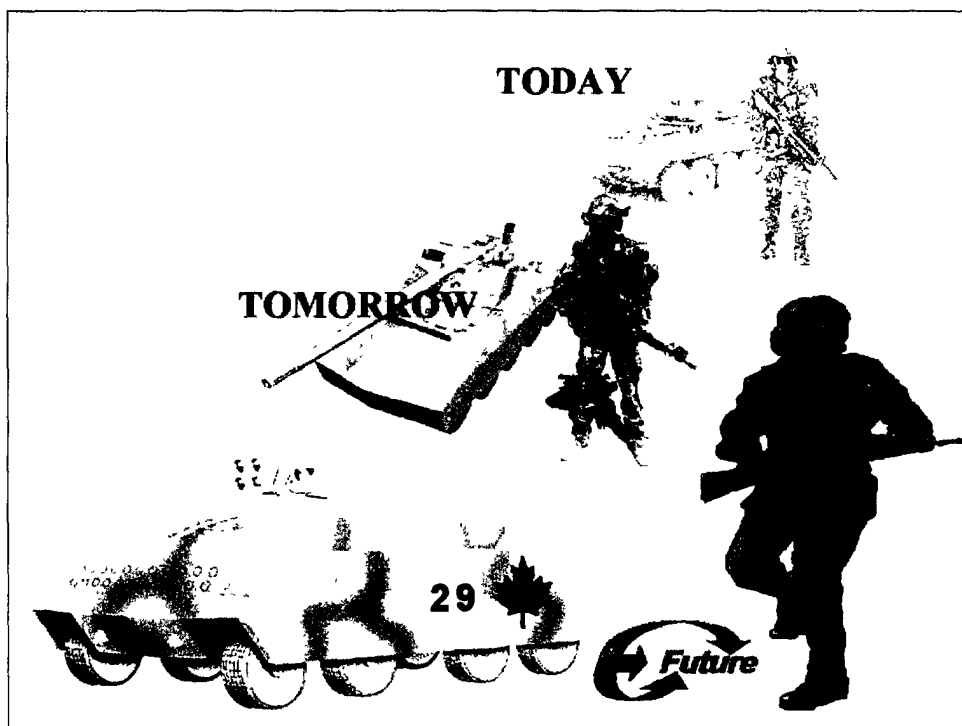




## **Future Army Model**

The Future Army will always be conceptual, therefore it will never actually exist. It is beyond current fiscal and policy constraints but within the timeframe when technological developments can reasonably be predicted.

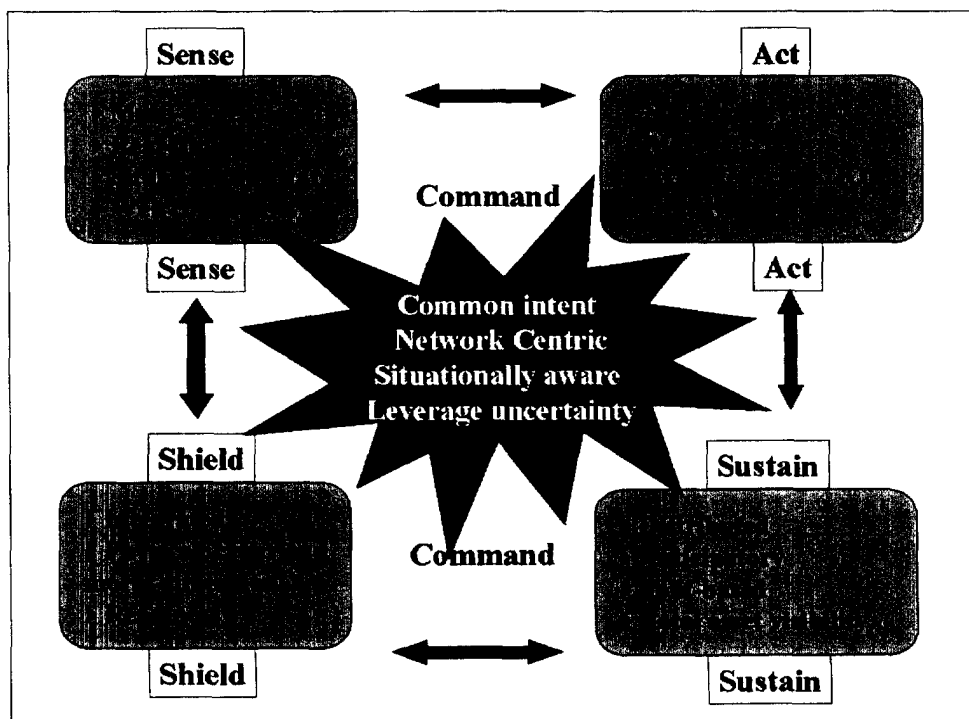
FADP March 1999



- **What must it do:**
  - **Combat capable, but adaptable for:**
    - **Stabilization Ops**
    - **Assistance Ops**
- **In what environment:**
  - **Expanded battlespace**
  - **Combined**
  - **Joint**
  - **Information age**

## FUTURE ARMY

- **How does it operate:**
  - **High readiness**
  - **Expandable**
  - **Decisive**
  - **Interoperable**
- **What are its attributes:**
  - **High tech**
  - **Well educated**
  - **Highly trained**
  - **Warrior spirit**



## ***DLSC Experiment***

### **Objective**

To measure differences in capability between evolutionary and revolutionary battle forces operating in the expanded battlespace circa 2020

### **Method**

Seminar wargame supported by OR/constructive modelling as appropriate. Incorporate Army Council insights, concept dev methods, tech demo and novel operational concepts.

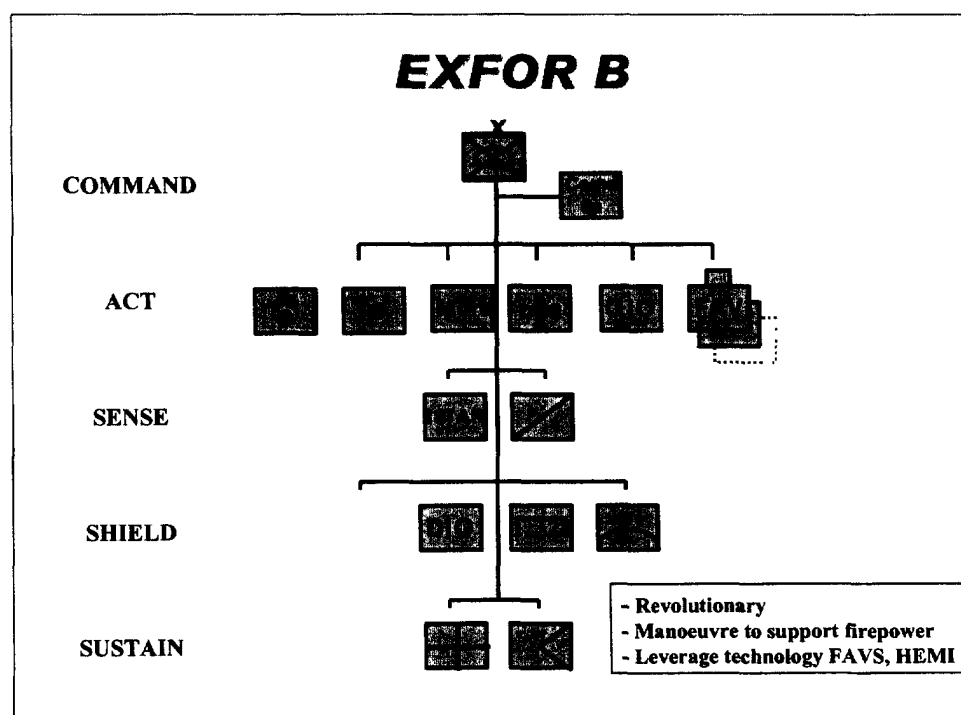
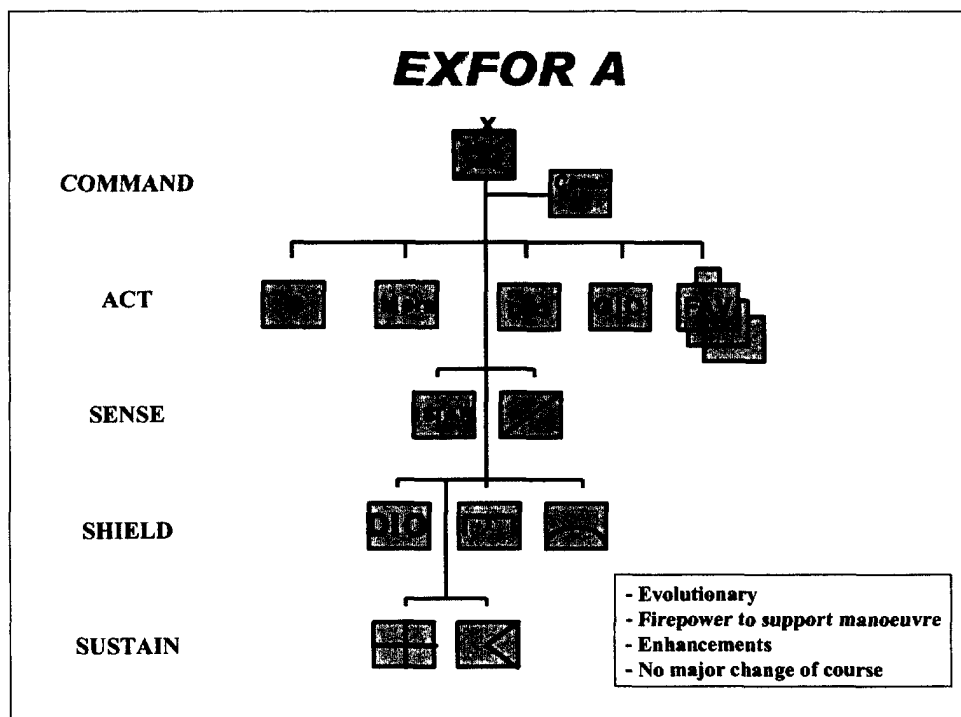
## ***Operational Concepts***

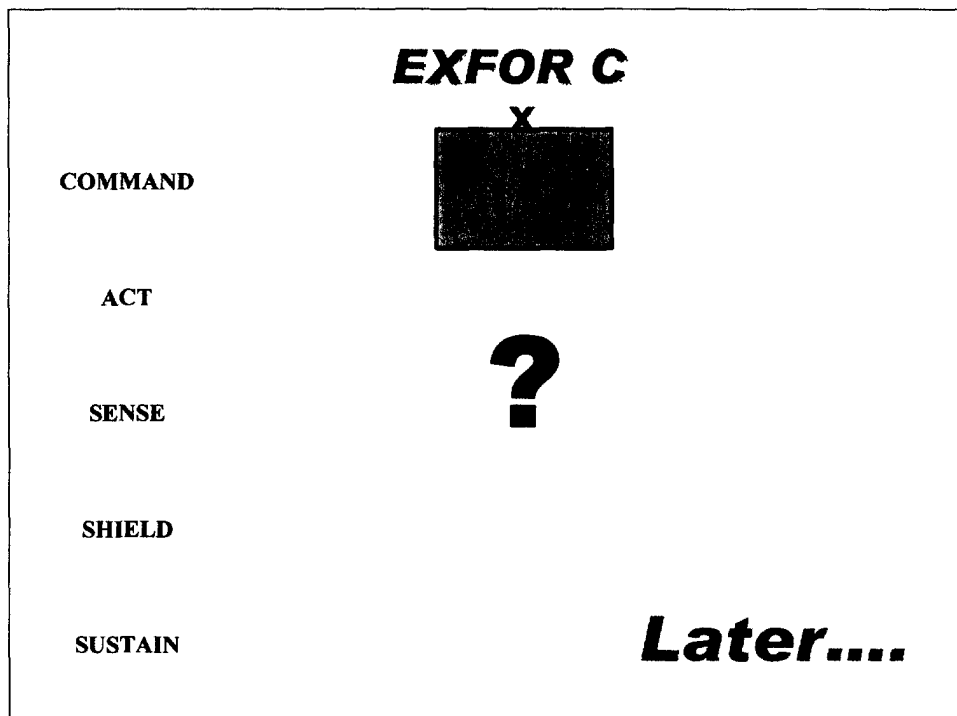
### **EXFOR A**

- Evolutionary force with a traditional org and structure to reflect 2020 tech improvements
- Purpose: Manoeuvre supported by firepower.
- Method: Manoeuvre to contact. Firepower to prep the battlespace and shield friendly force manoeuvre
- Close battle is integral
- Some modernization assumed

### **EXFOR B**

- Revolutionary force with a preponderance of Act/Firepower capabilities that deliver effects throughout the battlespace (close/extended regimes).
- Purpose: Firepower supported by manoeuvre.
- Method: Use extended firepower to attack enemy targets beyond contact ranges and degrade enemy combat capability to the extent that ground manoeuvre forces 'finish' missions under conditions favourable to BLUE
- Avoid close combat until necessary
- Leverage robotics; S&T to minimize pers & pers support requirements





## ***Future Capabilities***

- Future Effects
  - Extended Range
  - Offensive Info Ops
  - Avn Manoeuvre/  
Firepower
  - Close Effects
    - Ground Manoeuvre
    - HEMI/Multi-Role Gun
  - Sense System (ISTAR)
- Future Enablers
  - Full Spectrum Shield
  - Tactical Sustain
  - Defensive Info Ops

## ***Timelines***

- Feb -  
    Pre-ARWG
  - Mar -
    - preliminary seminars
    - modelling
    - threat/ground/Means of Effectiveness
  - Apr -
    - entity dev
    - excursions? (AEC/DREV)
  - May -  
    comparative experiment (14-18 May)  
    Discrete issues?
  - Jun -
    - Experiment Complete (4-8 June)  
    Report
- Follow-on activity
  - 2 Teams - Distinct capabilities
  - Collectively - common issues/capabilities
  - DAD/DLR
    - FAVs/HEMI/Indirect fire
    - Command support
    - ISTAR/sense

## ***June Army Council/Board***

- Format (mins):
  - Day 1
    - Central Presentation - Feedback (30 mins)
    - Experimentation Framework - Discussion (60 mins)
    - DLSC Experiment - Presentation/Discussion of Results/Recommendations (60 mins)
    - CLS Direction
    - Seminar Intro (30 mins) & Discussion (180 mins)
  - Day 2 (half day)
    - /Plenary (120 mins) & Conclusion (30 mins)

## ***June Army Council/Board***

- **Format:**
  - **Concept**
    - Breakout into groups
    - Explore issues relating to subject
    - Identify possible concepts relating to desired capabilities
    - Draft issues list for plenary discussion
    - Provide guidance relating to focus areas for concept development



**APPENDIX 6**  
**ANNEX A**  
**ORD PROJECT REPORT PR 2001/21**  
**NOVEMBER 2001**

**Army Sustainability Exercise**

**The ASX Model**

LCol Bob Gunn, DLSP 4  
 Mr Jason Offiong, LFORT 6

2 April 2001

**Outline**

- Goals of the ASX Model
- Planning, Reporting Accountability Structure (PRAS)
- Brief description of Activity Based Costing for the Army
- EQUITY<sup>®</sup>
  - Criteria
  - Evaluation of Units
  - Value for Cost

**ASX Objective**

- to identify an optimum, balanced mix of structure and activities obtainable within allocated resource levels,
- if the structure and activities identified above do not meet the requirements of present tasks, to identify those additional resources necessary to meet those tasks while achieving sustainability, and
- to identify the principal constraints which will restrict movement from the status quo to a balanced posture and rough options to deal with those impediments

**Goal**

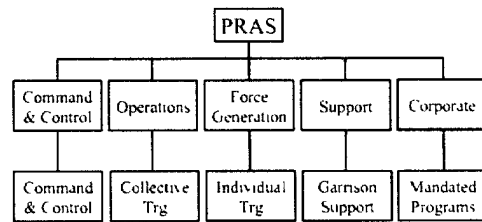
The goal of the ASX Model is to provide the means to perform a Value-for-Cost analysis of Army units. This enables the determination of an "optimum-mix" of the different capabilities provided by different units.

**Army Business**

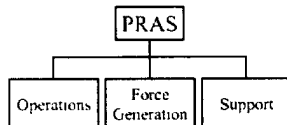
Two "Parts" to the Army's Business: Sustain and Change

- Sustain: ASX deals primarily with the sustainment issue of the Army of Today
- Change: ASX tackles sustainability with a view to the realities of the Army of Tomorrow / the Army of the Future

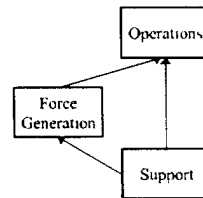
**PRAS Hierarchy**



**Operational Hierarchy**



**Realistic Hierarchy**



## COSTS

- Operations
  - Force Structure (PYs)
  - Collective Training (NP + activities)
  - Equipment
  - Individual Training
  - Garrison Support
- Force Generation
  - IT (Schools instructors overhead garrison support etc)
- Support Costs
  - Infrastructure
  - PYs
  - O&M

## EQUITY<sup>®</sup> Model

- Multi-Attribute Utility Theory (MAUT) model developed by London School of Economics
- Enables development of capability portfolios
- Provides Benefit vs Cost analysis of options
- Finds 'frontier points' that offer best bang for the buck

## Capability Portfolios

- Consist of
  - a unit type and size (e.g. mech inf bn, arty regt etc)
  - a readiness level (i.e. standard or high readiness) and
  - the number of like units in the Army (referred to as the level of effort)

Unit	Level	Costs	Benefits
1st Armoured Div	1	100	100
1st Armoured Div	2	200	200
1st Armoured Div	3	300	300
1st Armoured Div	4	400	400
1st Armoured Div	5	500	500
1st Armoured Div	6	600	600
1st Armoured Div	7	700	700
1st Armoured Div	8	800	800
1st Armoured Div	9	900	900
1st Armoured Div	10	1000	1000

## Evaluation Criteria

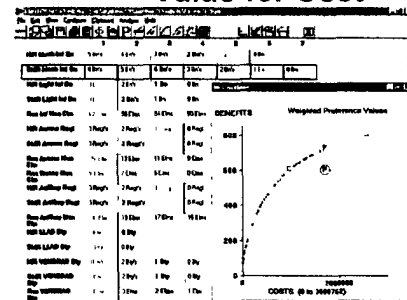
- Four weighted criteria
  - Scenarios measures the contribution of each capability portfolio element to a response to the scenarios
  - Taskings measures the ability of each capability portfolio element to accomplish CF taskings in addition to the primary role of the unit (be it at a standard or higher level of readiness or a Reserve element)
  - Footprint the effect and impact the element has on the visibility of DND/CF within its community
  - Mobilization the ability of each capability portfolio element to successfully transition through the stages of mobilization providing the required capacity for force employment generation and sustainment
- Weights to be determined at the start of the ASX

## Evaluation

- Each level of effort of unit type is evaluated against the "Benefit" Criteria
- Example for a Standard Readiness Mech Inf Bn

LEVEL	Costs	Benefits
1.0 Bn	100	100
2.0 Bn	200	200
3.0 Bn	300	300
4.0 Bn	400	400
5.0 Bn	500	500
6.0 Bn	600	600
7.0 Bn	700	700
8.0 Bn	800	800
9.0 Bn	900	900
10.0 Bn	1000	1000

## Value for Cost



## Questions?

APPENDIX 7  
ANNEX A  
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NOVEMBER 2001

# **Creating a Managed-Readiness System**

## **The Army Training & Operations Framework (ATOF)**

### **Agenda**

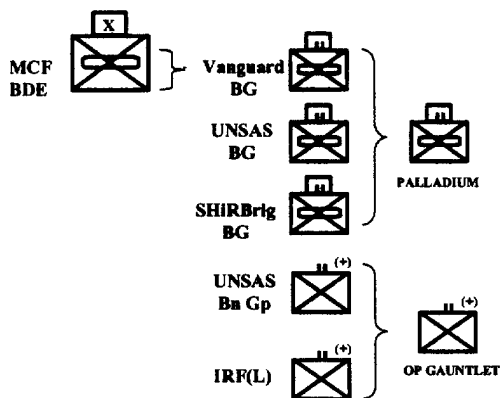
- Readiness capability requirements
- key concepts of managed-readiness
- An Army Training and Operations Framework

## **Readiness Capability Requirement**

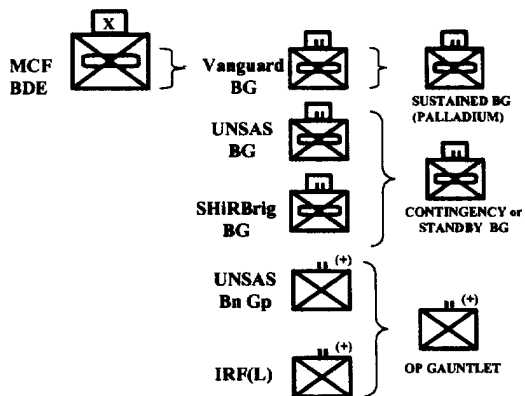
### **Commander's Intent**

- **Purpose:**
  - to correct current imbalance in the Army
- **Method:**
  - balance resource demand and availability
  - balance manpower demand and capacity
  - maximize capability through managed readiness
- **End state:**
  - a sustainable structure
  - a sustainable op/pers tempo

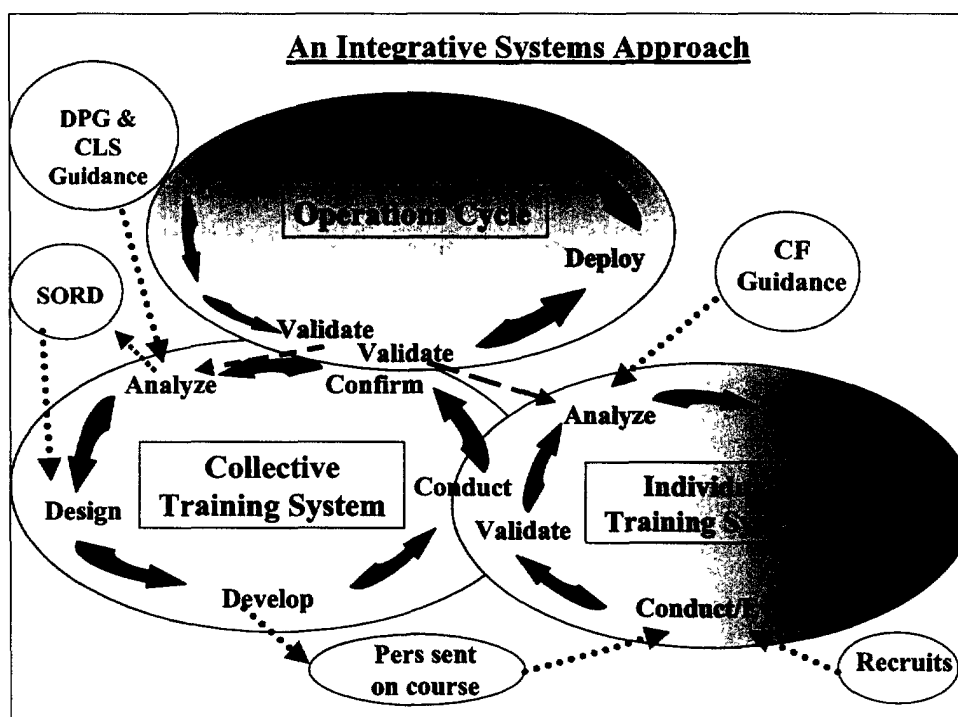
## Readiness Capability Requirement



## Readiness Capability Requirement

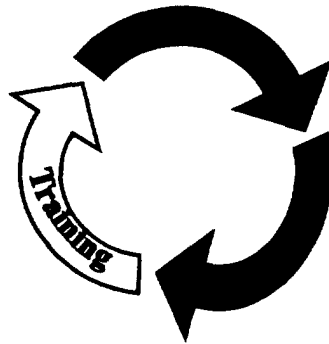


## Managed Readiness Concepts

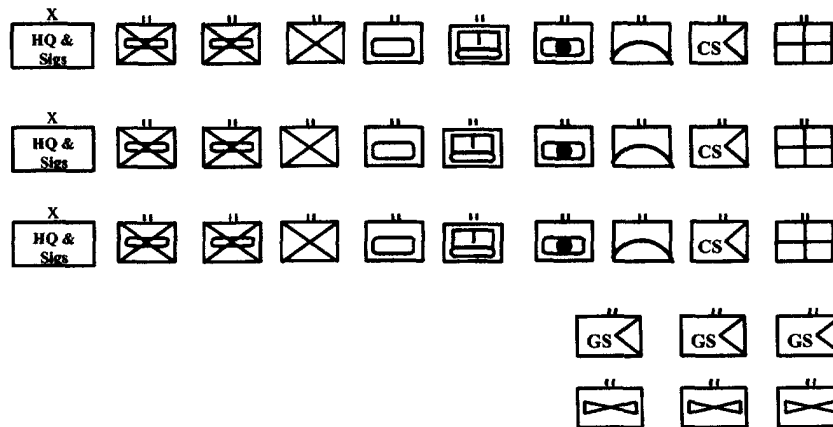


## Force Generation Cycle

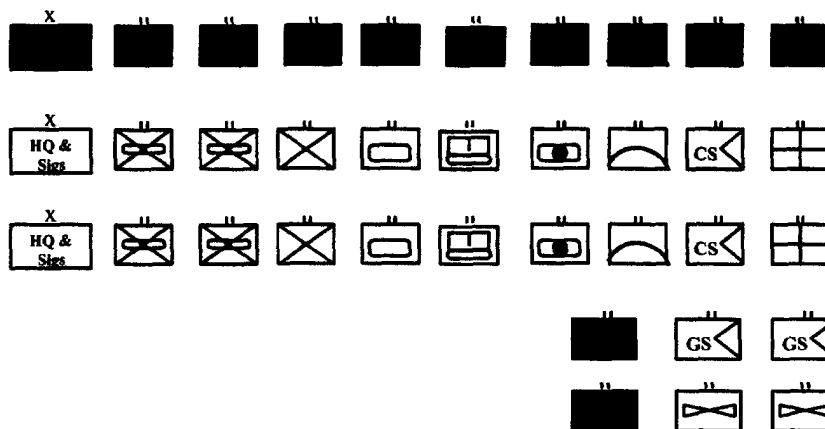
- One Force Generation Cycle
- Three Managed-Readiness Phases



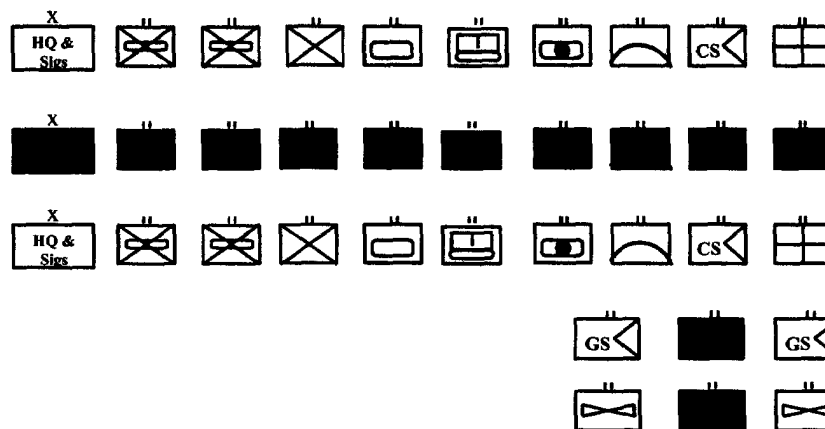
## Main Effort



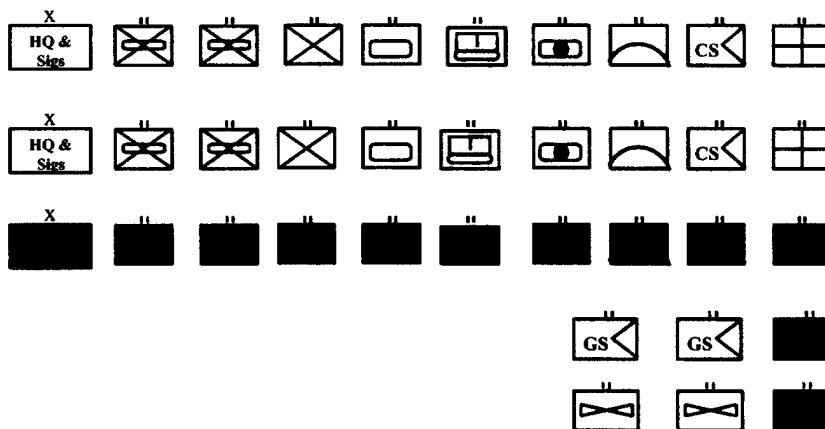
## Main Effort



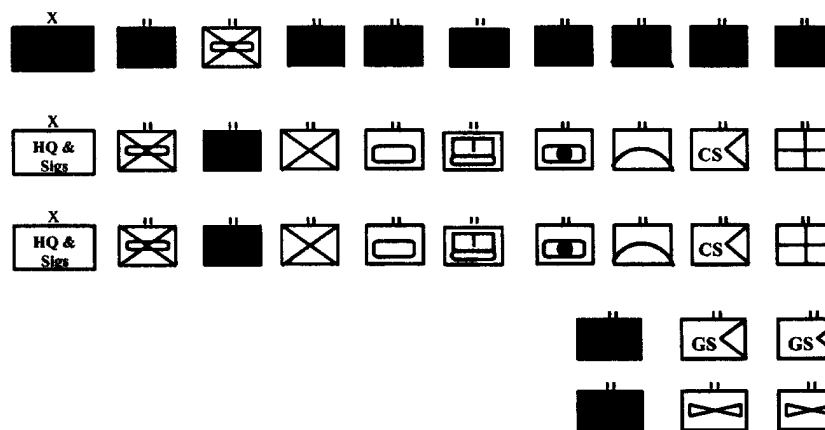
## Main Effort



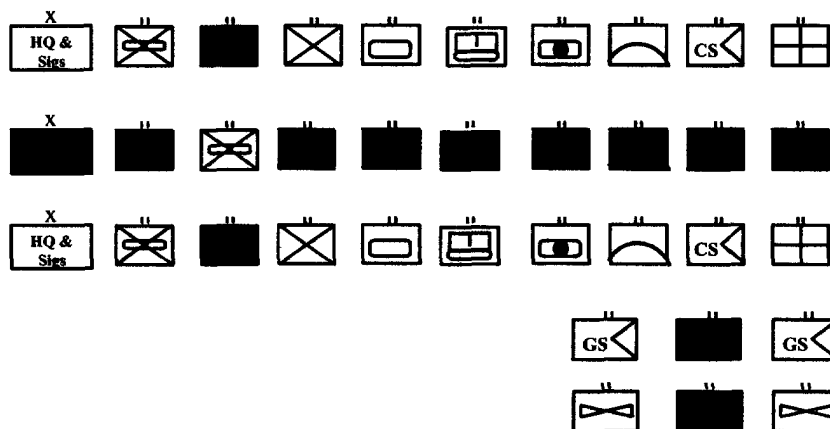
## Main Effort



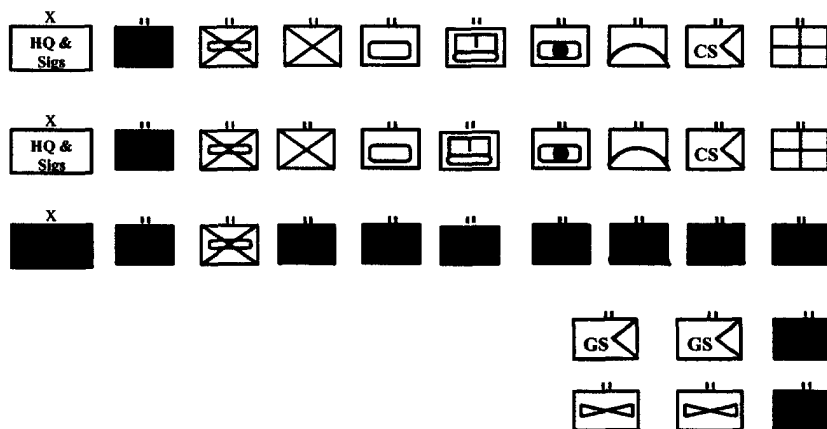
## Main Effort



## Main Effort



## Main Effort



- Meet DPG/Op Readiness Reqr

Be Robust

Preserve War fighting Skills

Sustain Taskings/APS

Max Benefit with Ltd resources

Integrate Prof Dev
- Be Progressive

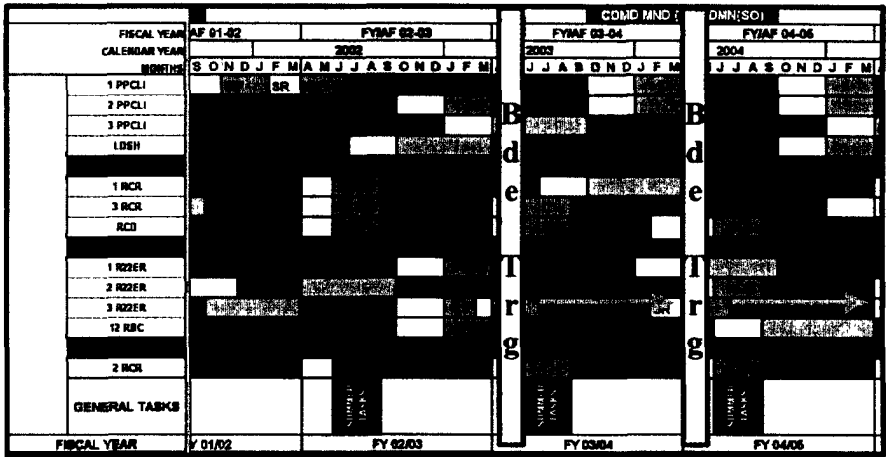
Sustain QOL

Promote Army Unity

Provide a 'Learning Mechanism'

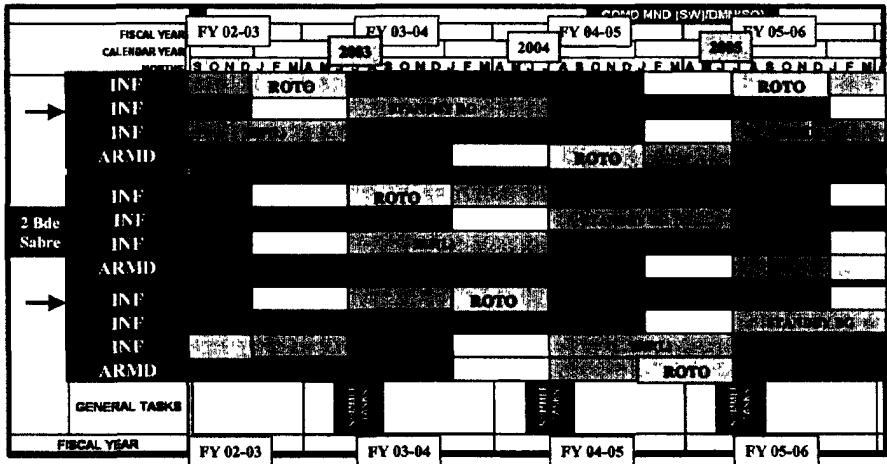
Incorporate Reserve Augmentation

Be Manageable

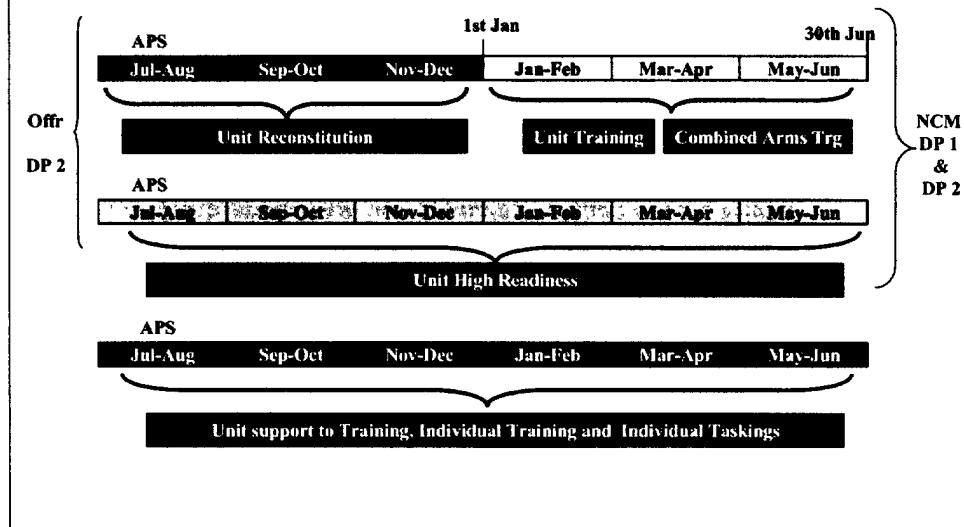


Managed Readiness under ATOF

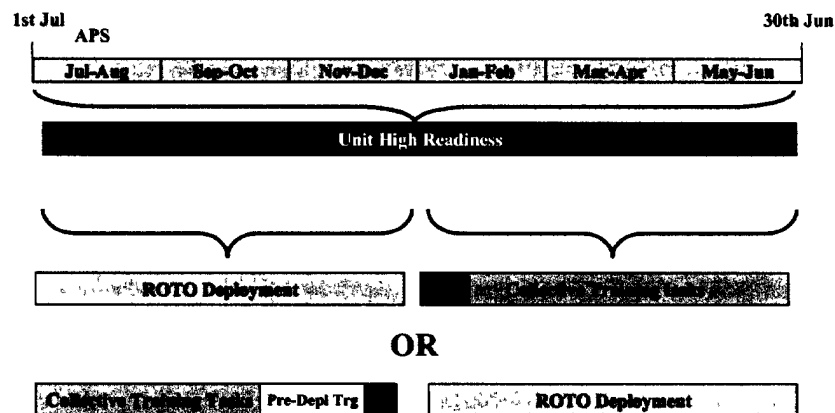
- ATOF (36 month cycle , 1 x BG sustained, 2 x High-Readiness Units)

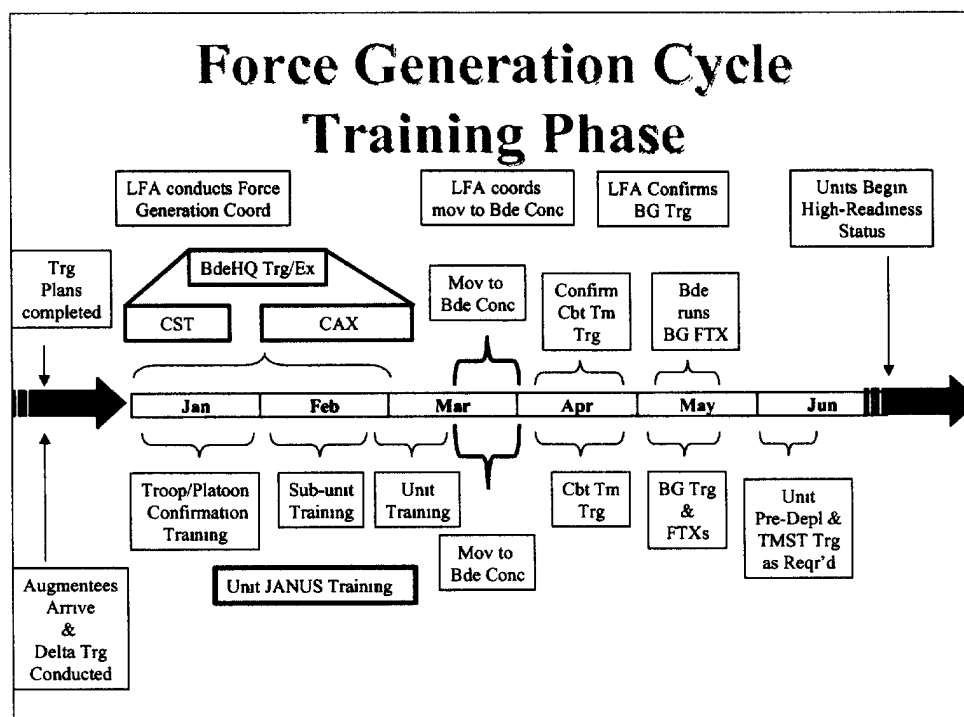
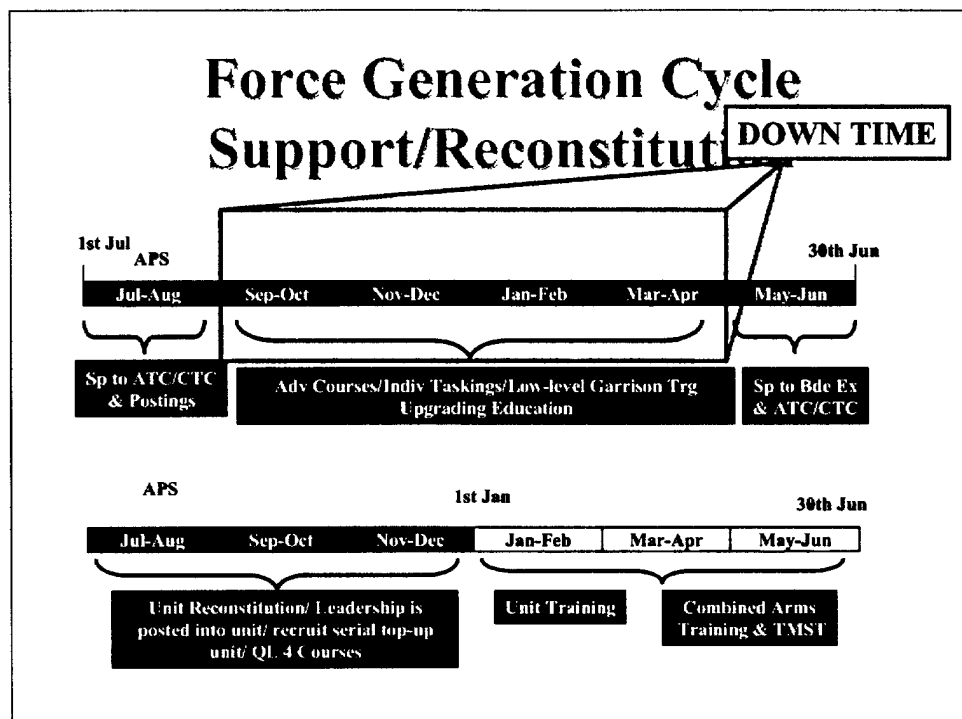


## Force Generation Cycle



## Force Generation Cycle Operations Phase

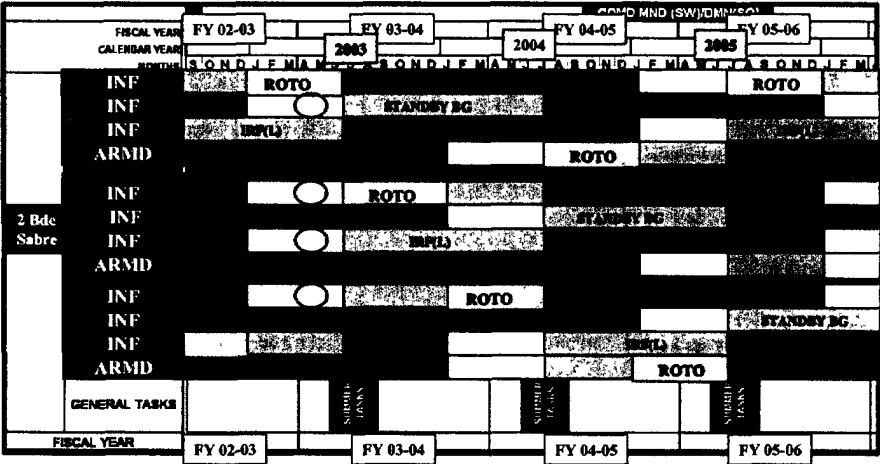




# Army Training and Operations Framework

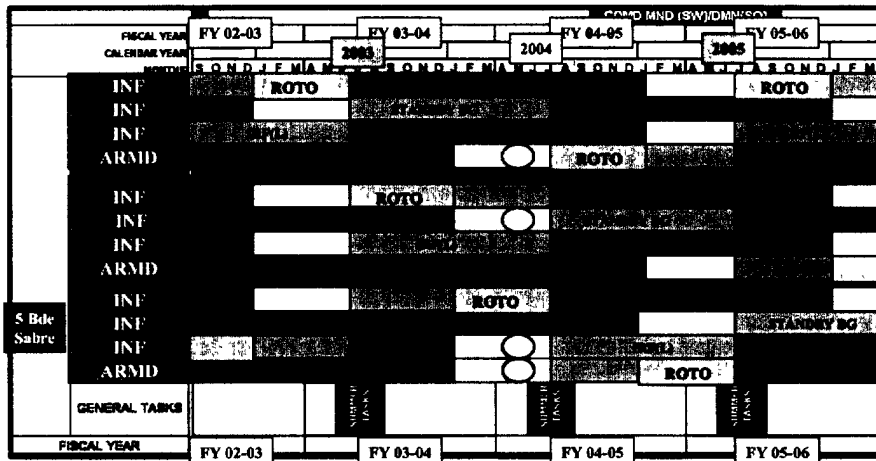
## Managed Readiness under ATOF

- ATOF (36 month cycle , 1 x BG sustained, 2 x High-Readiness Units)



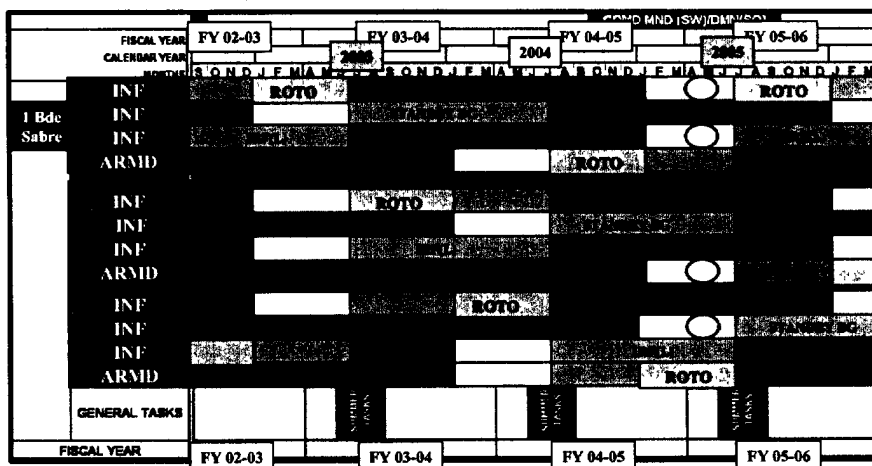
## Managed Readiness under ATOF

- ATOF (36 month cycle , 1 x BG sustained, 2 x High-Readiness Units)



## Managed Readiness under ATOF

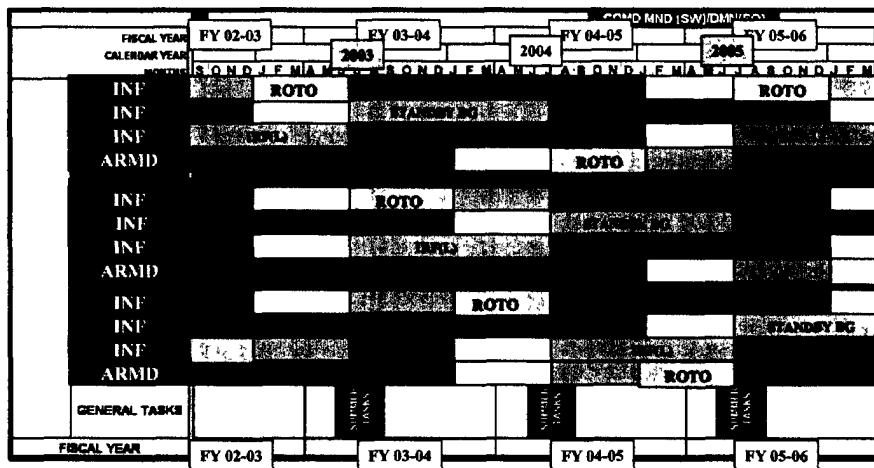
- ATOF (36 month cycle , 1 x BG sustained, 2 x High-Readiness Units)



## Options for ATOF

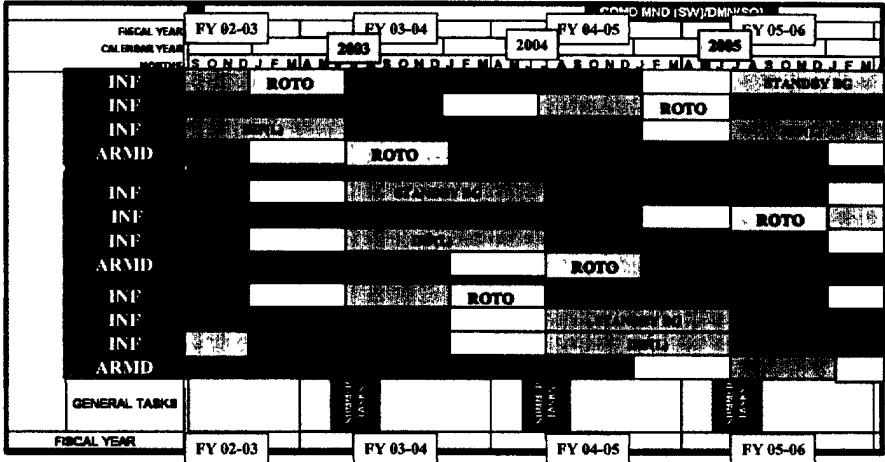
### Managed Readiness under ATOF - Option A

- OP TEMPO of Current Army (36 month cycle , 2 x deployments sustained)



# Managed Readiness under ATOF - Option B

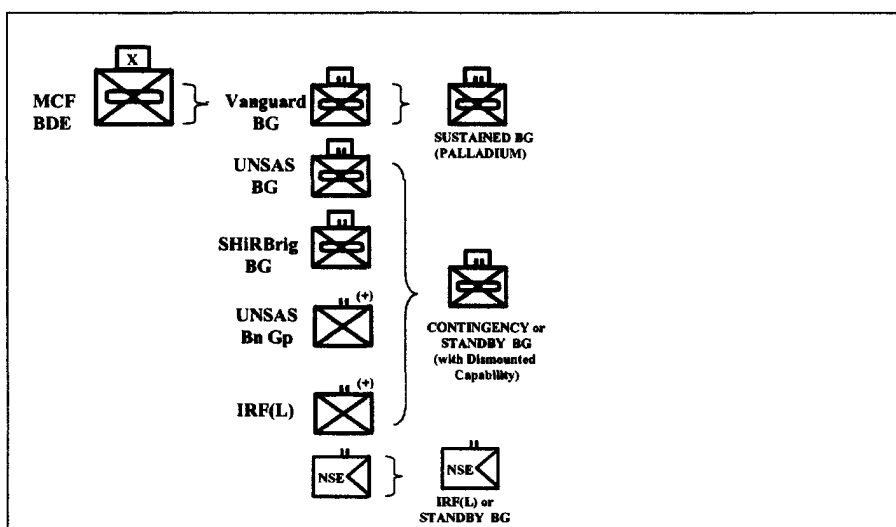
- OP TEMPO of Current Army (36 month cycle , 2 x deployments sustained)



Questions?

## Transformation

### Readiness Requirement with Transformation



## Transformation and ATOF Template

- **OP TEMPO of Transformation Option C (36 month, 1.5 x BG sustained)**

	FY 05-06	FY 06-07	FY 07-08	FY 08-09
CALIBER YEAR				
INF				
INF				
ARMID				
INF				
INF				
ARMID				
INF				
INF				
ARMID				
BG				
GENERAL TASKS				
FISCAL YEAR	FY 05-06	FY 05-06	FY 06-07	FY 07-08

APPENDIX 8  
ANNEX A  
ORD PROJECT REPORT PR 2001/21  
NOVEMBER 2001

### ASX COSTING MODEL

#### AIM

**"To provide the necessary costing data to support the development of ASX Models"**

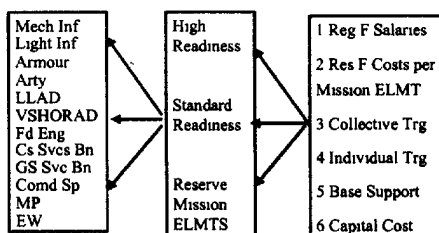
### ASX COSTING MODEL

#### The Approach

- Global - Macro Level view
- Based on Generic Operational ELMTS
- Parked elements :
  - HQs
  - Support to Non-Army Units
  - Mandated Programmes
- Variable and Fixed Costs

### ASX COSTING MODEL

#### 6 Major Cost Components



### ASX COSTING MODEL

#### 1. Reg F Salaries

By ELMT  
X  
Nb of Pys by Rank  
X  
Nb of ELMTS  
As per CFM 2001

#### 2. Reserve F Costs

- As per Reserve F Structure FY 01-02 cost per Msn ELMT
- Plus: Reg F Pys support by ELMT

### ASX COSTING MODEL

#### 3. Collective TRAINING

##### A. Veh Cost

(Veh type X Usage (Km) X Rate/Km X Nb Veh/ELMT)

##### B. Pers Trg Cost

(Pers cost/day) X Nb days by level trg X Nb Pys/ELMT

##### C. Ammo Cost

(Cost per ELMT/Level Trg)

### ASX COSTING MODEL

#### 4. Individual Training

- Sum of Indiv Trg School assigned to each ELMT based on Nb of Pys by MOC

##### • Schools

Infantry  
Armour  
Arty  
Tactics  
ATCs  
Log  
Eng  
MP  
Medical

Based on ABC data collection for each school includes Reg F salaries, Tasking cost and Base support

### ASX COSTING MODEL

#### 5. Base Support Cost

- |                       |                    |
|-----------------------|--------------------|
| • A. Pers Svcs        | • Nb of Pys/ELMT   |
| • B. Ops and Trg Svcs | • Nb Pers Trg days |
| • C. Tech Svcs        | • Nb Vehs + Nb Pys |
| • D. Infra            | • Sq metres        |
| • E. Other support    | • Nb of Pys        |

Based on weighted Avg cost of three main supporting Brigade Bases (ABC data collection)

### ASX COSTING MODEL

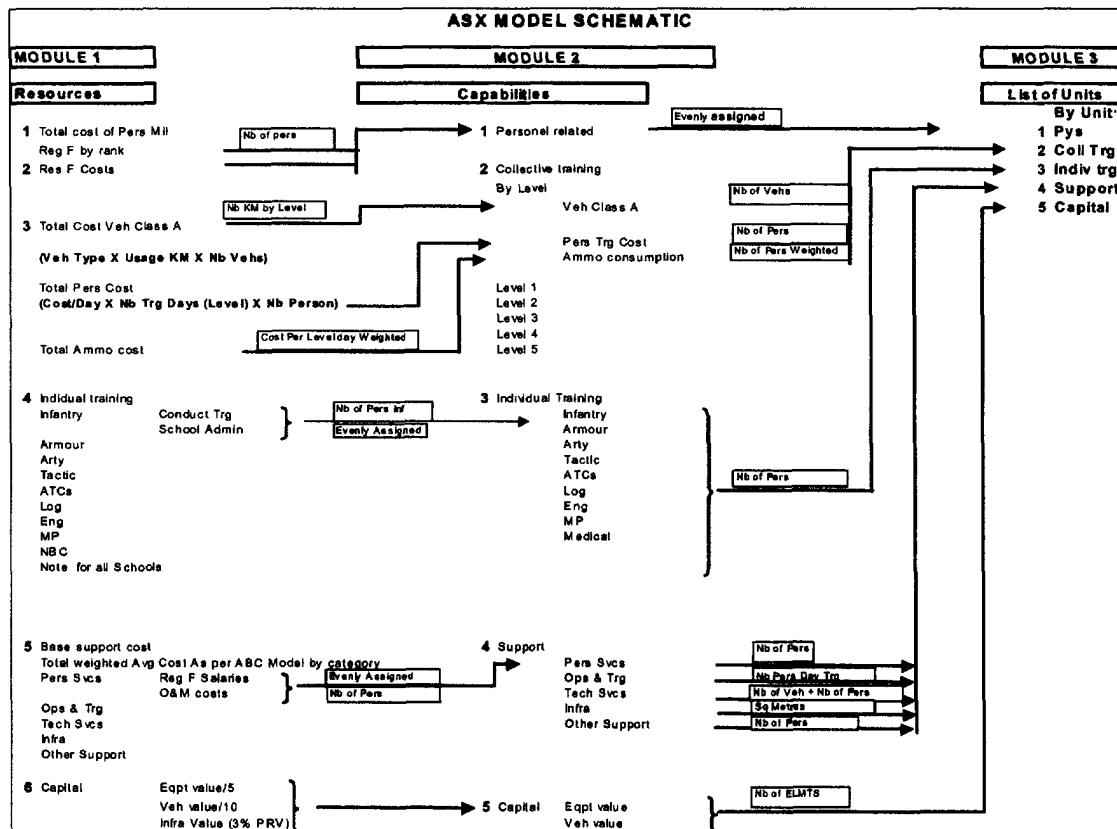
#### 6. Capital Cost

- |                           |             |
|---------------------------|-------------|
| • A. Equipment value      | • Nb Pys    |
| – 5 years depreciation    |             |
| • B. Vehicle value        | • Nb Vehs   |
| – 10 year depreciation    |             |
| • C. Infrastructure value | • Sq metres |
| – 3% of PRV               |             |

Capital cost is assigned to each ELMT based on the assign driver and each depreciation value Source of info DLFR-6 & CFSS Total Asset Viability

## ASX COSTING MODEL

- **Variable Parameters**
- **1. Quantity of ELMTs**
- **2. Consumption ration of each cost element**
  - Pys
  - Cell Trg
  - Ind Trg
  - Support
  - Capital

[illegible]

ANNEX B  
ORD PROJECT REPORT PR 2001/21  
NOVEMBER 2001

### **Army Sustainability Exercise Participants and their Affiliations**

A total of sixty-six personnel took part in the Army Sustainability Exercise (ASX) as participants or planning staff. These people and their affiliate organisations are given in Table B-I. Those participants that were also members of the ASX Working Group (ASX WG) are also indicated.

**TABLE B-I**  
**ASX PARTICIPANTS**

<b>ASX Participant</b>	<b>Organisation</b>
MGen Dempster	Land Staff
Col Barr	Land Force Western Area
Col Benjamin	Secteur du Québec de la Force Terrestre
Col Davies	Land Staff
Col Hatton	Land Force Atlantic Area
Col McQuillan	Land Staff
Col Peters	Land Staff
Col Semianiw	Land Force Doctrine and Training System
LCol Aitken	Land Staff
LCol Ap Probert	Land Force Doctrine and Training System
LCol Blanchette	Land Force Central Area
LCol Blom	Chief of the Air Staff
LCol Bryan	Vice Chief of Defence Staff
LCol Cyr	Land Force Western Area
LCol Duhamel (WG)	Land Staff
LCol Elvish	Assistant Deputy Minister (Material)
LCol Fletcher	Land Force Atlantic Area
LCol Gunn (WG)	Land Staff
LCol Haindl	Land Staff
LCol Labelle	Secteur du Québec de la Force Terrestre
LCol Lacroix	Deputy Chief of Defence Staff
LCol Lafleur	Land Force Central Area
LCol MacDonald	Land Force Atlantic Area
LCol MacLean	Land Force Doctrine and Training System
LCol McCabe	Land Force Atlantic Area
LCol Moffat	Department of Foreign Affairs International Trade
LCol Moore	Land Staff
LCol Mouatt	Land Force Central Area
LCol Pennington	Land Force Central Area
LCol Perreault	Secteur du Québec de la Force Terrestre

<b>ASX Participant</b>	<b>Organisation</b>
LCol Petit	Land Staff
LCol Porter	Land Force Western Area
LCol Quinn	Land Force Atlantic Area
LCol Ritchie	Assistant Deputy Minister (Human Resources-Military)
LCol Wright	Land Force Western Area
LCdr Knippel	Chief of the Maritime Staff
Maj Black	Land Staff
Maj Boivin	Land Staff
Maj Bouffard (WG)	Land Staff
Maj Butterworth	Land Force Doctrine and Training System
Maj Cote	Land Force Doctrine and Training System
Maj de Grandpre	Land Staff
Maj Eslegar	Land Force Western Area
Maj Fraser	Land Staff
Maj FritzMillet (WG)	Land Staff
Maj Gosbee	Land Force Doctrine and Training System
Maj Hope	Land Force Doctrine and Training System
Maj Hunter	Land Force Central Area
Maj Lamarre	Land Force Western Area
Maj Mainville (WG)	Land Staff
Maj Martel (WG)	Land Staff
Maj Morin	Land Staff
Maj Neumann	Land Force Western Area
Maj Nixon	Land Force Central Area
Maj Richard	Secteur du Québec de la Force Terrestre
Maj Schell	Land Staff
Maj Thurrot	Land Force Central Area
Maj Vaillancourt	Secteur du Québec de la Force Terrestre
Maj Vassbotn	Land Force Doctrine and Training System
Capt Doré	Secteur du Québec de la Force Terrestre
Capt Lewis	Land Staff
Cpl Jason	Land Staff
Mr. Hales (WG)	Directorate of Defence Analysis
Mr. Offiong (WG)	Director General Operational Research
Mr. Richards (WG)	Directorate of Defence Analysis
Ms. Rathwell	Land Staff

ANNEX C  
ORD PROJECT REPORT PR 2001/21  
NOVEMBER 2001

### Force Planning Scenario Demands

1. The Force Planning Scenario set is an integral part of capability-based planning. Staff of the Director General Strategic Planning developed the Scenarios beginning in 1997. The Force Planning Scenarios are intended to cover the entire spectrum of activities that the Canadian Forces could be involved with in the foreseeable future. In order to provide a range of possible responses and contributions to coalitions each scenario was split into several variants.

2. Listed below in Table C-I are the scenario and variant titles with significant Army contributions.

**TABLE C-I**  
**FORCE PLANNING SCENARIOS AND VARIANTS**  
**WITH SIGNIFICANT ARMY REQUIREMENTS**

#	Scenario Name	Variant	Description
1	Search and Rescue in Canada	1	Hunting party lost
		3	Majaid (Major Air Disaster)
2	Disaster Relief in Canada	1	Minor disaster
		2	Major disaster
3	International Humanitarian Assistance	1	DART (Disaster Assistance Response Team)
		2	Major humanitarian assistance
4	Surv/Control Canadian Territory	3	Air & Maritime with Sig C2
5	Evacuation of Canadians Overseas	1	Permissive evacuation
		2	Non-permissive evacuation
6	Peace Support Operations (Ch. 6)	1	Minor peace support
		2	Major peace support
7	Aid of the Civil Power	1	Minor aid to the civil power
		2	Major aid to the civil power
9	Peace Support Operations (Ch. 7)	1	Peace Support Operations (Ch. 7)
10	Defence of North America	1	Enhanced Brigade
		2	Full Main Contingency Force
11	Collective Defence	1	Vanguard Battle Group
		4	Full Main Contingency Force

3. The Scenario Operational Capability Risk Assessment Model (SOCRAM) can provide a risk assessment for a proposed force structure. In order to do this SOCRAM compares the amount of operational assets in the force structure against a demand for

those assets generated by concurrent activation of the scenarios. In this context the amount of risk is the percentage of time that the amount of operational assets in the force structure is insufficient to meet the demand. To make this assessment SOCRAM needs information concerning the response required to meet the mission requirements of each of the scenario variants.

4. In connection with the ASX several groups provided the scenario variant response data to provide a range of input values. This data is listed below in Table C-II.

**TABLE C-II**  
**SCENARIO DEMANDS**

Scen.	Var.	ASX WG (DLSP) # Unit Type	ASX Syndicate 2 # Unit Type	ASX Syndicate 5 # Unit Type	DDA # Unit Type
1	1	$\frac{1}{3}$ Any Army Unit	$\frac{1}{3}$ Any Army Unit	$\frac{1}{3}$ Any Army Unit	$\frac{1}{3}$ Any Army Unit
1	3	$\frac{1}{3}$ Any Army Unit	$\frac{1}{3}$ Light Inf Bn	$\frac{1}{3}$ Any Army Unit	$\frac{1}{3}$ Any Inf Unit
2	1	$\frac{1}{2}$ Comd Sp Bn $\frac{1}{3}$ Any Engr Unit $\frac{1}{3}$ Any Svc Unit 1 CIMIC 1 Any Cbt Unit		$\frac{1}{6}$ Comd Sp Bn $\frac{1}{3}$ Any Engr Unit $\frac{1}{3}$ Any Svc Unit $\frac{1}{6}$ CIMIC 1 Any Cbt Unit	$\frac{1}{6}$ Comd Sp Bn $\frac{1}{3}$ Any Engr Unit $\frac{1}{3}$ Any Svc Unit $\frac{1}{6}$ CIMIC 1 Any Cbt Unit
2	2	1 1 Comd Sp Bn 1 Any Engr Unit 1 Any Svc Unit 1 3 CIMIC Any Inf Unit  1 1 Armour Regt 1 Artillery Regt 1 MP Pl	1 Comd Sp Bn 1 Fd Engr Regt 1 CS Svc Bn  1 Lt Inf Bn 2 Mech Inf Bn  1 MP Pl	2 Comd Sp Bn 2 Any Engr Unit 2 CS Svc Bn 2 GS Svc Bn 1 CIMIC 8 Any Cbt Unit  2 MP Pl 8 Res Combat	1 Comd Sp Bn 1 Any Engr Unit 1 Any Svc Unit  1 CIMIC 3 Any Inf Unit  2 Any Cbt Unit 1 Armour Regt 1 Artillery Regt 1 MP Pl
3	1	$\frac{1}{3}$ Any Army Unit	$\frac{1}{3}$ Any Cbt Unit	$\frac{1}{3}$ Any Cbt Unit $\frac{1}{6}$ Any Engr Unit	$\frac{1}{3}$ Any Cbt Unit
3	2	$\frac{1}{2}$ Comd Sp Bn $\frac{1}{3}$ Any Engr Unit  $\frac{1}{3}$ Any Svc Unit 1 Any Army Unit	$\frac{1}{4}$ Comd Sp Bn $\frac{1}{4}$ Fd Engr Regt $\frac{1}{4}$ Engr Sp Regt $\frac{1}{4}$ CS Svc Bn $\frac{1}{4}$ GS Svc Bn 1 Lt Inf Bn	$\frac{1}{6}$ Comd Sp Bn $\frac{1}{3}$ Any Engr Unit  $\frac{1}{2}$ Any Svc Unit 1 Any Cbt Unit $\frac{1}{2}$ MP Pl	$\frac{1}{4}$ Comb Sp Bn $\frac{1}{3}$ Any Engr Unit  $\frac{1}{3}$ Any Svc Unit 1 Any Cbt Unit $\frac{1}{3}$ MP Pl
4	3	1 Any AD Bty	$\frac{1}{4}$ LLAD Bty $\frac{1}{4}$ EW Sqn	$\frac{1}{3}$ LLAD Bty $\frac{1}{2}$ EW Sqn $\frac{1}{6}$ Comd Sp Bn $\frac{1}{3}$ Armour Regt	$\frac{1}{3}$ LLAD Bty $\frac{1}{4}$ EW Sqn $\frac{1}{6}$ Comd Sp Bn $\frac{1}{3}$ Armour Regt
5	1	1 Any Inf Unit 1 MP Pl $\frac{1}{3}$ Armour Regt	$\frac{1}{3}$ Lt Inf Bn	$\frac{1}{3}$ Lt Inf Bn $\frac{1}{2}$ MP Pl	$\frac{1}{4}$ Comd Sp Bn $\frac{1}{3}$ Any Svc Unit 1 Mech Inf Bn $\frac{1}{2}$ MP Pl $\frac{1}{3}$ Armour Regt

Scen.	Var.	ASX WG (DLSP) # Unit Type	ASX Syndicate 2 # Unit Type	ASX Syndicate 5 # Unit Type	DDA # Unit Type
5	2	1 Any Inf Unit 1 MP Pl  1/3 Armour Regt 1 JTF2	1/3 Lt Inf Bn	1/6 Comd Sp Bn 1 Lt Inf Bn 1/3 Mech Inf Bn 1/2 MP Pl 1/3 Any Engr Unit 1/3 EW Sqn	1/3 Comd Sp Bn 1 Mech Inf Bn  1/2 MP Pl 1/3 Any Engr Unit 1/3 EW Sqn 1/3 Any Svc Unit 1/3 Armour Regt
6	1	1 Any Cbt Unit		1/6 Comd Sp Bn 1 Mech Inf Bn 1/3 Any Engr Unit 1/2 Any Svc Unit 1/2 MP Pl	1/4 Comd Sp Bn 1 Mech Inf Bn 1/3 Any Engr Unit 1/2 Any Svc Unit 1/2 MP Pl
6	2	1/2 Comd Sp Bn 1 Any Cbt Unit  1/3 Any Svc Unit  1/2 MP Pl	1 Mech Inf Bn 1/3 Fd Engr Regt 1/4 CS Svc Bn 1/4 GS Svc Bn 1/3 Armour Regt 1/3 LLAD Bty 1/2 MP Pl	1/6 Comd Sp Bn 1 Mech Inf Bn 1/3 Any Engr Unit 1/2 Any Svc Unit  1/3 Armour Regt  1/2 MP Pl	1/2 Comd Sp Bn 1 Mech Inf Bn 1/3 Any Engr Unit 1/2 Any Svc Unit  1/3 Armour Regt  1/2 MP Pl
7	1	1/2 Comd Sp Bn 1 Any Cbt Unit  1/3 Any Svc Unit 1 CIMIC		1/6 Comd Sp Bn 1 Mech Inf Bn 1/3 Armour Regt 1/3 Any Svc Unit 1/2 CIMIC 1/3 Any Engr Unit 1 MP Pl 1/2 EW Sqn	1/6 Comd Sp Bn 1 Mech Inf Bn 1/3 Armour Regt 1/3 Any Svc Unit 1/3 CIMIC 1/3 Any Engr Unit 1 MP Pl 1/2 EW Sqn
7	2	1 Comd Sp Bn 3 Any Inf Unit  1 Armour Regt 1 Artillery Regt 1 Any Svc Unit  1 Any Engr Unit 1 CIMIC 1 MP Pl	1 Comd Sp Bn 2 Mech Inf Bn 1 Lt Inf Bn 1 Armour Regt  1 CS Svc Bn 1/2 GS Svc Bn  2 MP Pl	1 Comd Sp Bn 3 Mech Inf Bn  1 Armour Regt 1 Artillery Regt 2 Any Svc Unit  1 Any Engr Unit 1 CIMIC 1 EW Sqn 1 MP Pl	1 Comd Sp Bn 3 Mech Inf Bn 1 Lt Inf Bn 1 Armour Regt  1 Any Svc Unit  1 Any Engr Unit 1 CIMIC 1 EW Sqn 1 MP Pl
9	1	1/3 Comd Sp Bn 1 Any Inf Unit 1/3 Armour Regt 1/3 Artillery Regt 1/3 Any Svc Unit	1 Comd Sp Bn 3 Mech Inf Bn 1 Armour Regt 1 Artillery Regt 1 CS Svc Bn 3 GS Svc Bn 1 Fd Engr Regt 1 Engr Sp Regt 1 MP Pl 1 EW Sqn  1 LLAD Bty 1 VSHORAD Bty	1/3 Comd Sp Bn 1 Mech Inf Bn 1/3 Armour Regt 1/3 Artillery Regt 1/2 Any Svc Unit  1/3 Fd Engr Regt  1/2 MP Pl 1/2 EW Sqn 1 CIMIC	1/3 Comd Sp Bn 1 Mech Inf Bn 1/3 Armour Regt 1/3 Artillery Regt 1/2 Any Svc Unit  1/3 Fd Engr Regt  1/2 MP Pl 1/2 EW Sqn 1/3 CIMIC

Scen.	Var.	ASX WG (DLSP)		ASX Syndicate 2		ASX Syndicate 5		DDA	
		#	Unit Type	#	Unit Type	#	Unit Type	#	Unit Type
10	1	1	Comd Sp Bn	2	Comd Sp Bn	1	Comd Sp Bn		
		3	Any Inf Unit	4	Mech Inf Bn	3	Mech Inf Bn		
		1	Armour Regt	2	Lt Inf Bn	1	Armour Regt		
		1	Artillery Regt	2	Armour Regt	1	Artillery Regt		
		1	Any Engr Unit	2	Fd Engr Regt	1	Any Engr Unit		
		1	Any Svc Unit	2	CS Svc Bn	2	Any Svc Unit		
				1	GS Svc Bn				
				$\frac{3}{2}$	LLAD Bty	1	LLAD Bty		
						1	VSHORAD Bty		
				1	EW Sqn	1	EW Sqn		
		1	MP Pl	2	MP Pl	1	MP Pl		
						1	CIMIC		
				42	Res Inf	13	Res Inf		
				10	Res Armour	3	Res Armour		
						4	Res Artillery		
				6	Res Recce	2	Res Recce		
				8	Res Fd Engr	3	Red Fd Engr		
				14	Res Svc Bn	5	Res Svc Bn		
				2	Res MP Coy	1	Res MP Coy		
						1	Res VSHORAD		
10	2	1	Comd Sp Bn			1	Comd Sp Bn		
		3	Any Inf Unit	1	Mech Inf Bn	3	Mech Inf Bn		
		1	Armour Regt	$\frac{1}{3}$	Armour Regt	1	Armour Regt		
		1	Artillery Regt	$\frac{1}{3}$	Artillery Regt	1	Artillery Regt		
		1	Any Engr Unit			1	Any Engr Unit		
		1	CS Svc Bn		CS Svc Bn	2	Any Svc Unit		
		1	GS Svc Bn	$\frac{1}{4}$					
		1	Any AD Bty			1	LLAD Bty		
						1	VSHORAD Bty		
		3	MP Pl	$\frac{1}{4}$	MP Pl	1	ME Pl		
						1	EW Sqn		
						1	CIMIC		
						13	Res Inf		
						3	Res Armour		
						4	Res Artillery		
						2	Res Recce		
						3	Res Fd Engr		
						5	Res Svc Bn		
						1	Res MP Coy		
						1	Res VSHORAD		
11	1	$\frac{1}{2}$	Comd Sp Bn			$\frac{1}{3}$	Comd Sp Bn	$\frac{1}{3}$	Comd Sp Bn
		1	Any Inf Unit			1	Mech Inf Bn	1	Mech Inf Bn
		$\frac{1}{3}$	Armour Regt			$\frac{1}{3}$	Armour Regt	$\frac{1}{3}$	Armour Regt
		$\frac{1}{3}$	Artillery Regt			$\frac{1}{3}$	Artillery Regt	$\frac{1}{3}$	Artillery Regt
		$\frac{1}{3}$	Any Svc Unit			$\frac{1}{2}$	Any Svc Unit	$\frac{1}{2}$	Any Svc Unit
						$\frac{1}{3}$	Fd Engr Regt	$\frac{1}{3}$	Fd Engr Regt
						$\frac{1}{2}$	MP Pl	$\frac{1}{2}$	MP Pl
						$\frac{1}{2}$	EW Sqn	$\frac{1}{2}$	EW Sqn
						1	CIMIC	$\frac{1}{3}$	CIMIC

Scen.	Var.	ASX WG (DLSP)		ASX Syndicate 2		ASX Syndicate 5		DDA	
		#	Unit Type	#	Unit Type	#	Unit Type	#	Unit Type
11	4	1	Comd Sp Bn	1	Comd Sp Bn	1	Comd Sp Bn	1	Comd Sp Bn
		3	Any Inf Unit	3	Mech Inf Bn	3	Mech Inf Bn	3	Mech Inf Bn
		1	Armour Regt	1	Armour Regt	1	Armour Regt	1	Armour Regt
		1	Artillery Regt	1	Artillery Regt	1	Artillery Regt	1	Artillery Regt
		1	Any Engr Unit	1	Fd Engr Regt	1	Any Engr Unit	1	Fd Engr Regt
				1	Engr Sp Regt			1	Engr Sp Regt
		1	CS Svc Bn	1	CS Svc Bn	2	Any Svc Unit	1	CS Svc Bn
		1	GS Svc Bn	3	GS Svc Bn			1	GS Svc Bn
		1	Any AD Bty	2	LLAD Bty	1	LLAD Bty	1	LLAD Bty
				2	VSHORAD Bty	1	VSHORAD Bty	1	VSHORAD Bty
		3	MP Pl	1	MP Pl	1	MP Pl	1	MP Pl
				1	EW Sqn	1	EW Sqn	1	EW Sqn
						1	CIMIC	1	CIMIC

ANNEX D  
ORD PROJECT REPORT PR 2001/21  
NOVEMBER 2001

**Army Sustainability Exercise Data Forms**

A number of forms had to be designed to gather data from the participants at the ASX. Sample blank forms are included as follows to provide guidance should a similar exercise be held in the future:

- a. Figure D-1 – Complete Capability Area Valuation Form;
- b. Figure D-2 – Regular Force Capability Area Valuation Form;
- c. Figure D-3 – Reserve Force Capability Area Valuation Form;
- d. Figure D-4 – Reserve Force bridging scores;
- e. Figure D-5 – EQUITY criteria weighting form used with the Analytic Hierarchy Process; and
- f. Figure D-6 – EQUITY scenario weighting form used with the Analytic Hierarchy Process.

	Element Levels of Effort					
High Readiness Mechanized Infantry Battalion	5	4	3	2	1	
Standard Readiness Mechanized Infantry Battalion	6	5	4	3	2	1
High Readiness Light Infantry Battalion	4	3	2	1		
Standard Readiness Light Infantry Battalion	4	3	2	1		
Reserve Infantry Mission Element	62	58	54	50	46	
High Readiness Armour Regiment	3	2	1			
Standard Readiness Armour Regiment	3	2	1			
Reserve Armour Mission Element	15	13	11	9		
Reserve Recce Mission Element	9	7	5			
High Readiness Artillery Regiment	3	2	1			
Standard Readiness Artillery Regiment	3	2	1			
Reserve Artillery Mission Element	21	19	17	15		
High Readiness LLAD Battery	1					
Standard Readiness LLAD Battery	1					
High Readiness VSHORAD Battery	3	2	1			
Standard Readiness VSHORAD Battery	3	2	1			
Reserve VSHORAD Mission Element	4	3	2			
High Readiness Field Engineer Regiment	3	2	1			
Standard Readiness Field Engineer Regiment	3	2	1			
Reserve Field Engineer Mission Element	12	10	8	6		
High Readiness Engineer Support Regiment	1					
Standard Readiness Engineer Support Regiment	1					
High Readiness CS Service Battalion	3	2	1			
Standard Readiness CS Service Battalion	3	2	1			
Reserve Service Battalion Mission Element	22	20	18	16		
High Readiness MP Platoon	3	2	1			
Standard Readiness MP Platoon	3	2	1			
Reserve MP Company	4	3	2	1		
High Readiness Command Support Battalion	3	2	1			
Standard Readiness Command Support Battalion	3	2	1			
High Readiness GS Service Battalion Component	3	2	1			
Standard Readiness GS Service Battalion Component	3	2	1			
Reg EW Sqn	1					
Rank:	Classification:		Position:			

Figure D-1 – Complete capability area valuation form.

	Score for Element Levels of Effort						
	7	6	5	4	3	2	1
Mechanized Infantry Battalion							
Light Infantry Battalion							
Armour Regiment							
Artillery Battery							
LLAD Battery							
VSHORAD Battery							
Field Engineer Regiment							
Engineer Support Regiment							
CS Service Battalion							
Command Support Battalion							
Rank: Classification: Position:							

Figure D-2 – Regular Force capability area valuation form.

	Score Reserve Element Levels of Effort				
	62	58	54	50	46
Reserve Infantry Mission Element					
Reserve Armour Mission Element					
Reserve Recce Mission Element					
Reserve Artillery Mission Element					
Reserve VSHORAD Mission Element					
Reserve Field Engineer Mission Element					
Reserve Service Battalion Mission Element					
Reserve MP Company					
Rank: Classification: Position:					

Figure D-3 – Reserve Force capability area valuation form.

## **Regular/Reserve Relative Value Conversion**

This number will be used to calibrate the Scenario value of the Reserve units to their Regular Force counterpart. This evaluation should consider the personnel establishment, training and equipment issues. Consider that it takes five part-time Reservists to produce one full-time equivalent. The numbers should be expressed as a percentage

<b>Regular Unit / Sub-Unit</b>	<b>Reserve Unit</b>	<b>Percentage of Regular Value</b>
Lt Inf Bn	Inf Bn	
Armd Regt	Armd Regt	
Armd Regt	Recce Regt	
Arty Regt	Fd Arty Regt	
VSHORAD Bty	VSHORAD Bty	
Fd Engr Regt	Fd Engr Regt	
CS Svc Bn	Svc Bn	

**Figure D-4 –Reserve Force bridging scores.**

	Scenarios	Taskings	Footprint	Mobilization
Scenarios	1			
Taskings		1		
Footprint			1	
Mobilization				1

Figure D-5 – EQUITY criteria weighting form used with the Analytic Hierarchy Process.

	Scenano 1	Scenano 2	Scenano 3	Scenano 4	Scenano 5	Scenano 6	Scenano 7	Scenano 8	Scenano 9	Scenano 10	Scenano 11
Scenano 1	1										
Scenano 2		1									
Scenano 3			1								
Scenano 4				1							
Scenano 5					1						
Scenano 6						1					
Scenano 7							1				
Scenano 8								1			
Scenano 9									1		
Scenano 10										1	
Scenano 11											1

Figure D-6 – EQUITY scenario weighting form used with the Analytic Hierarchy Process.

ANNEX E  
ORD PROJECT REPORT PR 2001/21  
NOVEMBER 2001

## **Complete EQUITY® Results**

The most significant results from the Army Sustainability Exercise are the viable, although not validated, Army force structures developed by the five Syndicates. These represent potential future force structures tailored to meet the Army's missions and tasks as well as addressing the present affordability issues. These Syndicate solutions were developed based on outputs (force structure options) from the EQUITY® model.

Contained here is a set of the key EQUITY results and charts depicting some of the raw data that the model used. While explained in greater detail below, the first several Figures will show the force structure options that EQUITY generated. The remainder of the Figures will show the valuation results for each of the units. Not included here are the results for each unit type in each of the four assessment criteria, Scenarios, Taskings, Mobilisation and Footprint. These complete results are available on CD attached to this Project Report in the Operational Research Division (ORD) Library.

### **FORCE STRUCTURE RESULTS**

The Figures E1, E3 and E5 show the force structure options that EQUITY recommended for the Total-Force, The Regular Force and the Reserve Force respectively. Similarly, Figures E2, E4 and E6 show the corresponding cost-benefit graphs. In these latter Figures, the value and cost of the Army of Today are represented at the point "P". The "B" point represents a possible force structure that has roughly the same cost as "P", but has a greater value. Similarly, the "C" point represents a force structure that has roughly the same output as "P", but costs less. Finally, the "F" point is an affordable Army (the set of green boxes on Figures E1, E3 and E5). Note that for all of the Value vs. Cost plots, the costs are in Thousands of dollars.

Equity Force Structure for Regular and Reserve Force Units								
Mech Inf Bn	7 Bn's	<b>6 Bn's</b>	5 Bn's	<b>4 Bn's</b>	3 Bn's	2 Bn's	1 Bn	0 Bn
Light Inf Bn	4 Bn's	<b>3 Bn's</b>	2 Bn's	1 Bn	0 Bn			
Res Inf Men Elm	66 Elms	<b>62 Elms</b>	58 Elms	54 Elms	50 Elms	46 Elms	0 Elms	
Armour Regt	4 Regt's	<b>3 Regt's</b>	2 Regt's	1 Regt	0 Regt			
Res Armour Men Elm	17 Elms	<b>15 Elms</b>	13 Elms	11 Elms	9 Elms	0 Elms		
Res Recce Men Elm	11 Elms	<b>9 Elms</b>	7 Elms	5 Elms	0 Elms			
Artillery Regt	4 Regt's	<b>3 Regt's</b>	2 Regt's	<b>1 Regt</b>	0 Regt			
Res Artillery Men Elm	23 Elms	<b>21 Elms</b>	19 Elms	17 Elms	15 Elms	0 Elms		
LLAD Bty	2 Bty's	<b>1 Bty</b>	0 Bty					
VSHORAD Bty	<b>2 Bty's</b>	<b>1 Bty</b>	0 Bty					
Res VSHORAD Bty	<b>5 Elms</b>	<b>4 Elms</b>	3 Elms	2 Elms	0 Elms			
Field Engr Regt	4 Regt's	<b>3 Regt's</b>	2 Regt's	1 Regt	0 Regt			
Res Fd Engr Men Elm	14 Elms	<b>12 Elms</b>	10 Elms	8 Elms	6 Elms	0 Regt		
Engr Sp Regt	2 Regt's	<b>1 Regt</b>	0 Regt					
CS Service Bn	4 Bn's	<b>3 Bn's</b>	2 Bn's	1 Bn	0 Bn			
Res Svc Bn Men Elm	24 Elms	<b>22 Elms</b>	20 Elms	18 Elms	16 Elms	0 Bn		
Comd Sp Bn	4 Bn's	<b>3 Sqn's</b>	2 Sqn's	1 Sqn	0 Sqn			
Overhead		<b>Parked Elements</b>						

Figure E-1 – EQUITY Force Structure for Regular and Reserve Force Units. The EQUITY solution is highlighted in green. The emboldened items depict the Army's current force structure. The blue line shows the last item "purchased" and the red one shows the next on.

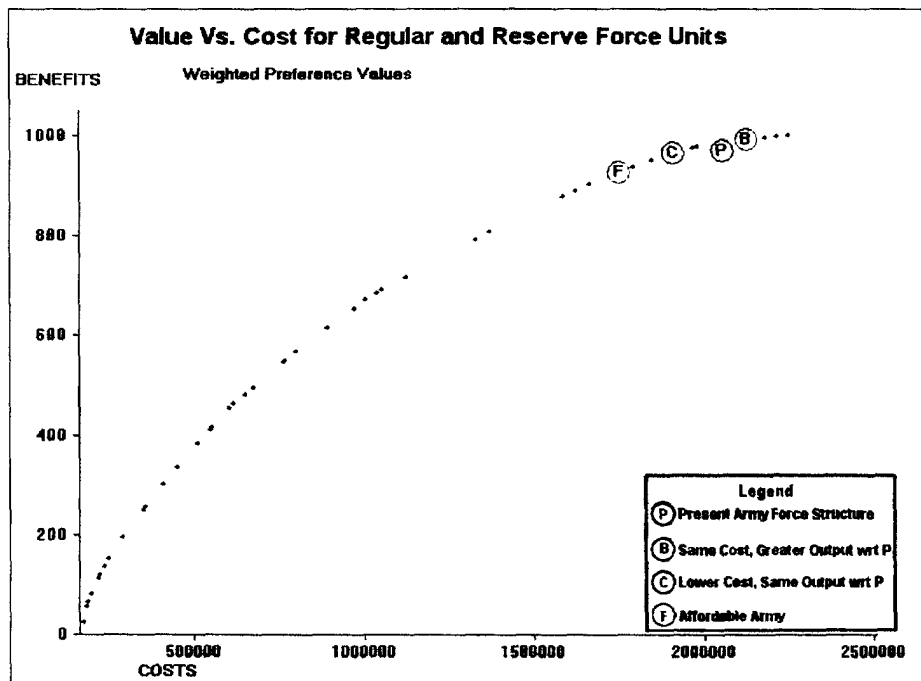


Figure E-2 – Value vs. Cost for Regular and Reserve Force Units (corrected cost data).

Equity Force Structure for Regular Force Units								
	7 Bn's	6 Bn's	5 Bn's	4 Bn's	3 Bn's	2 Bn's	1 Bn	0 Bn
Mech Inf Bn								
Light Inf Bn	4 Bn's	3 Bn's	2 Bn's	1 Bn	0 Bn			
Armour Regt	4 Regt's	3 Regt's	2 Regt's	1 Regt	0 Regt			
Artillery Regt	4 Regt's	3 Regt's	2 Regt's	1 Regt	0 Regt			
LLAD Bty	2 Bty's	1 Bty	0 Bty					
VSHORAD Bty	2 Bty's	1 Bty	0 Bty					
Field Engr Regt	4 Regt's	3 Regt's	2 Regt's	1 Regt	0 Regt			
Engr Sp Regt	2 Regt's	1 Regt	0 Regt					
CS Service Bn	4 Bn's	3 Bn's	2 Bn's	1 Bn	0 Bn			
Comd Sp Bn	4 Bn's	3 Sqn's	2 Sqn's	1 Sqn	0 Sqn			
Overhead	Parked Elements							

Figure E-3 – EQUITY Force Structure for Regular Force Units.

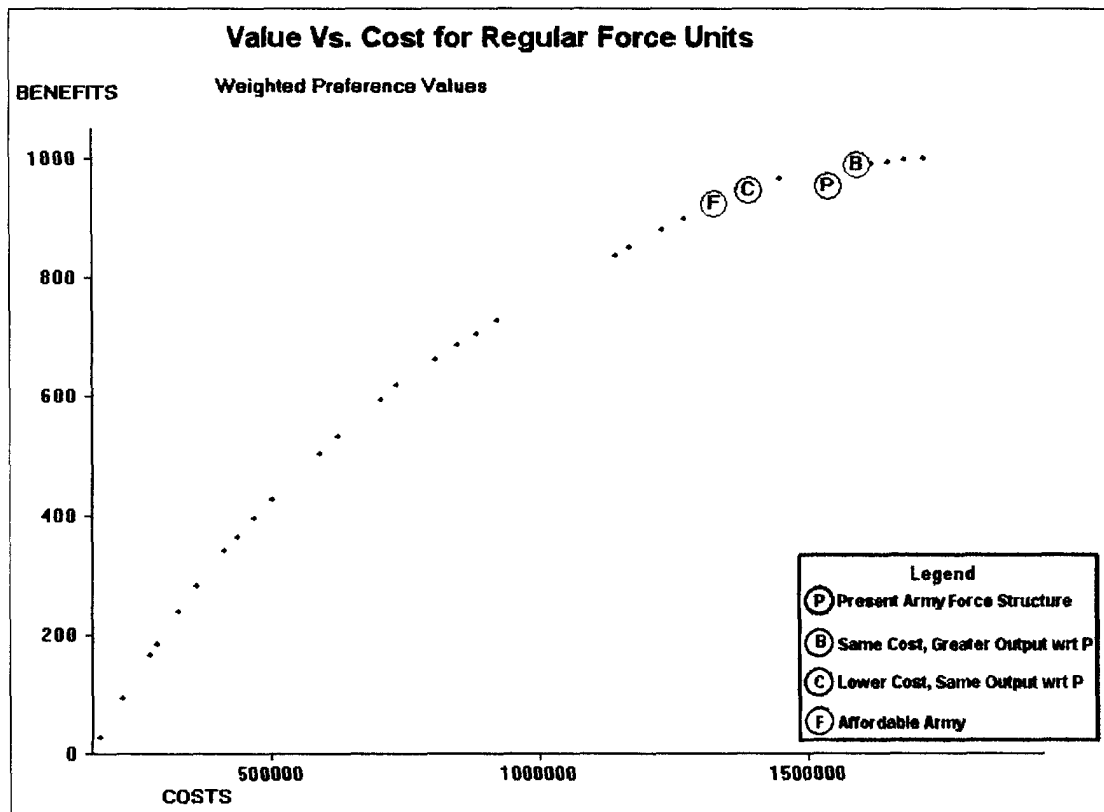


Figure E-4 – Value vs. Cost for Regular Force Units (corrected cost data created after the ASX).

Equity Force Structure for Reserve Force Units						
Res Inf Msn Elm	66 Elms	62 Elms	58 Elms	54 Elms	50 Elms	46 Elms
Res Armour Msn Elm	17 Elms	15 Elms	13 Elms	11 Elms	9 Elms	0 Elms
Res Recce Msn Elm	11 Elms	9 Elms	7 Elms	5 Elms	0 Elms	
Res Arty Msn Elm	23 Elms	21 Elms	19 Elms	17 Elms	15 Elms	0 Elms
Res VSHORAD Bty	5 Elms	4 Elms	3 Elms	2 Elms	0 Elm	
Res Fd Engr Msn Elm	14 Elms	12 Elms	10 Elms	8 Elms	6 Elms	0 Elms
Res Svc Bn Msn Elm	24 Elms	22 Elms	20 Elms	18 Elms	16 Elms	0 Bn
Overhead	Parked Elements					

Figure E-5 – EQUITY Force Structure for Reserve Force Units.

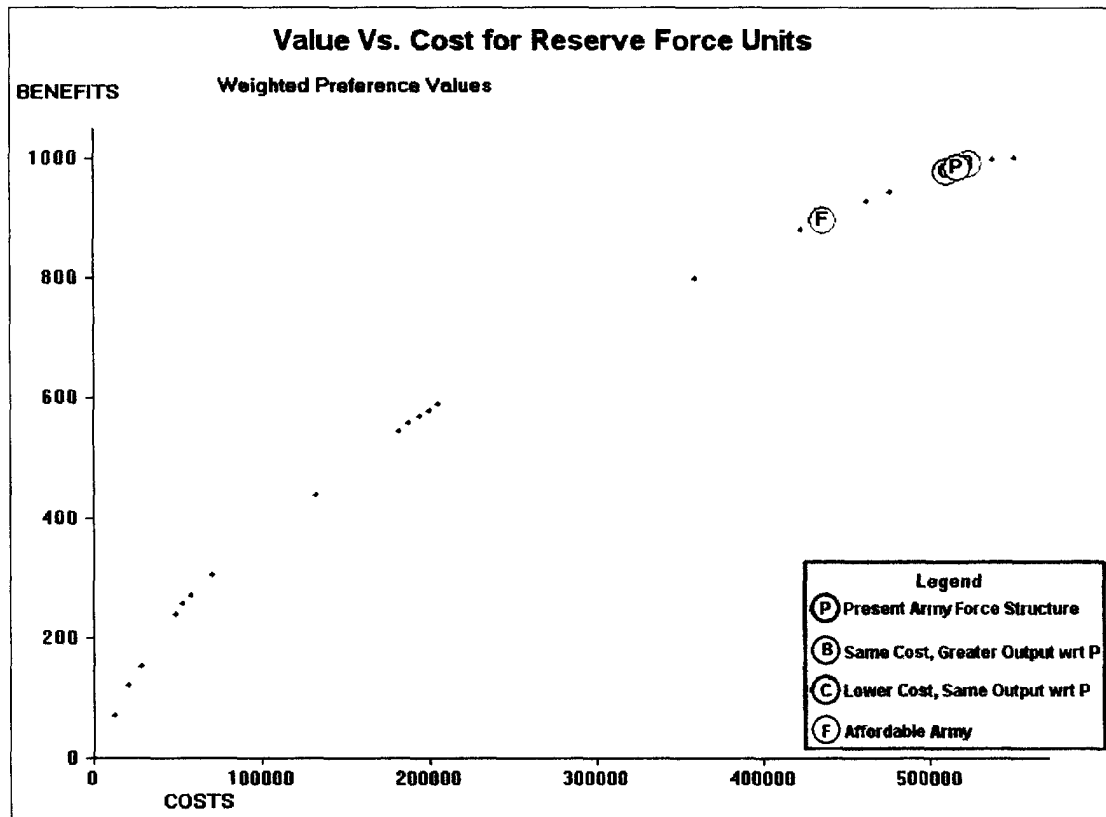


Figure E-6 – Value vs. Cost for Reserve Force Units (corrected cost data).

## VALUATION DATA

The remaining Figures show the valuation data for the levels of effort of each unit type, both Regular and Reserve. Only the overall value (determined from the valuations of the units in the four criteria, Scenarios, Taskings, Mobilisation and Footprint) of each unit type is presented here.

## REGULAR FORCE DATA

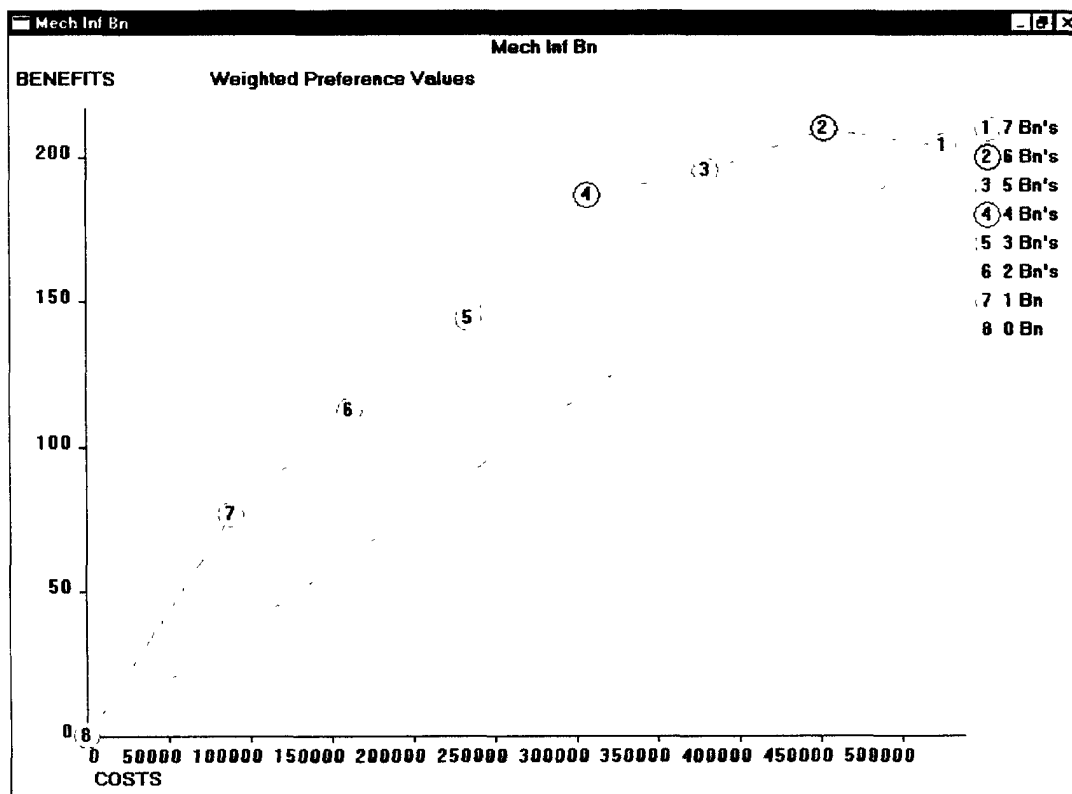


Figure E-7 – Valuation data for a Regular Force Mechanised Infantry Battalion.

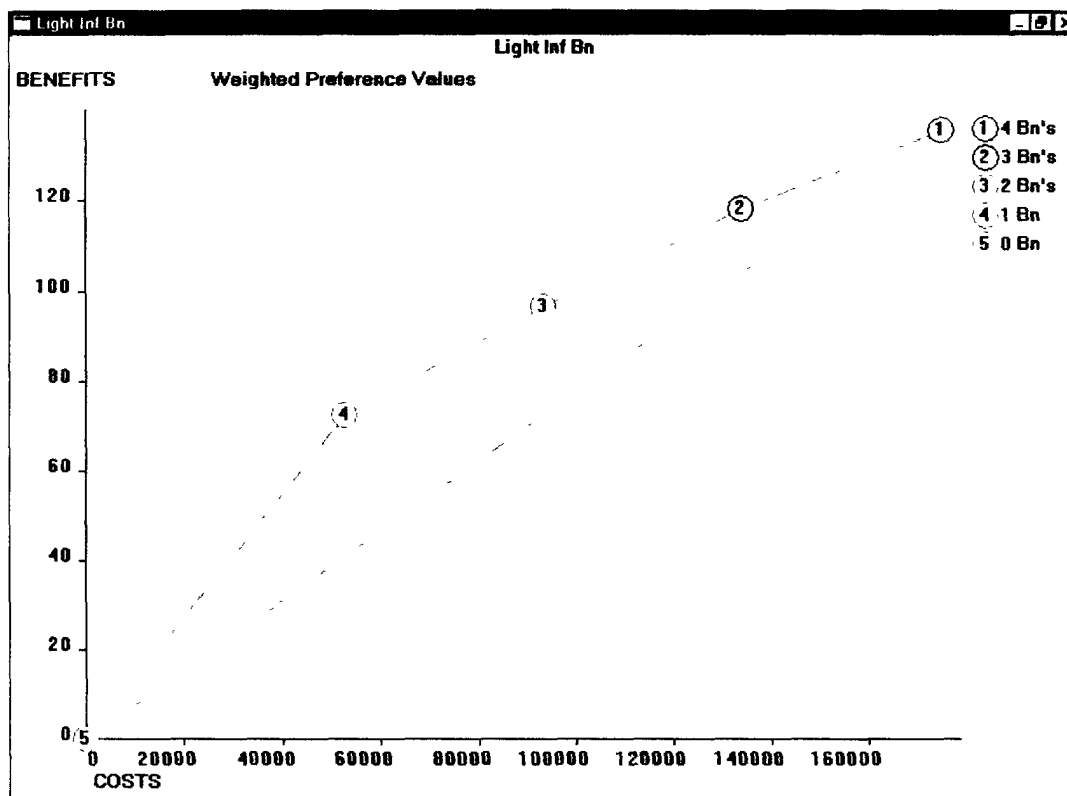


Figure E-8 – Valuation data for a Regular Force Light Infantry Battalion.

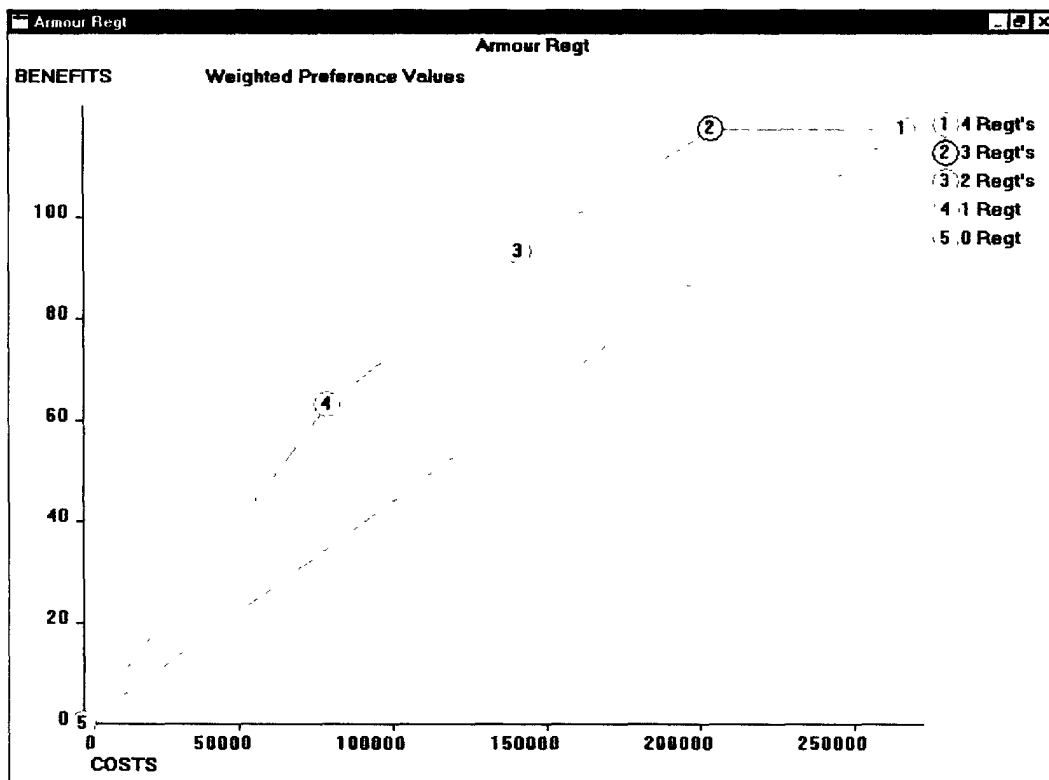


Figure E-9 – Valuation data for a Regular Force Armoured Regiment.

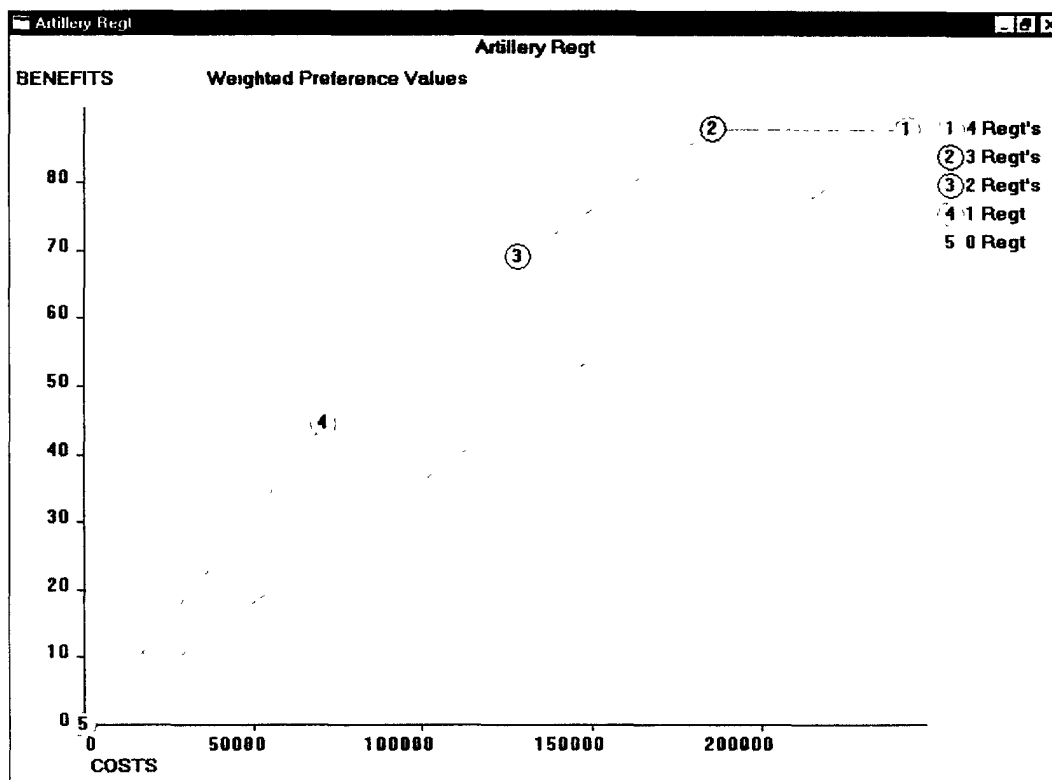


Figure E-10 – Valuation data for a Regular Force Armoured Regiment.

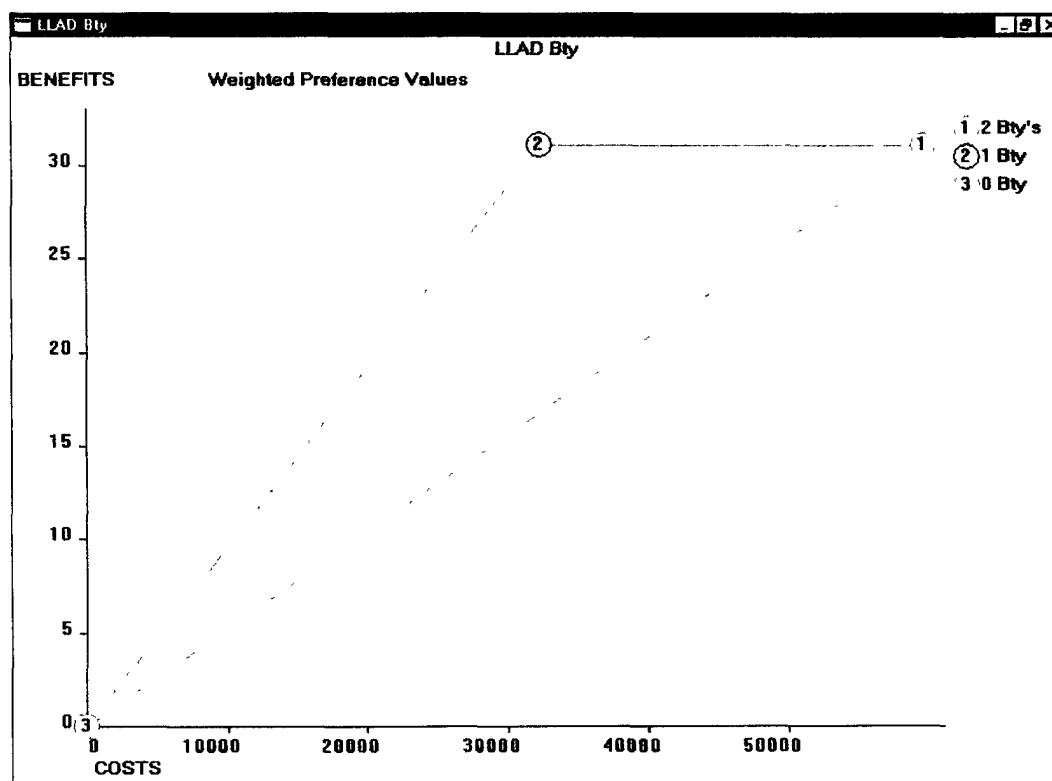


Figure E-11 – Valuation data for a Regular Force Low Level Air Defence Battery.

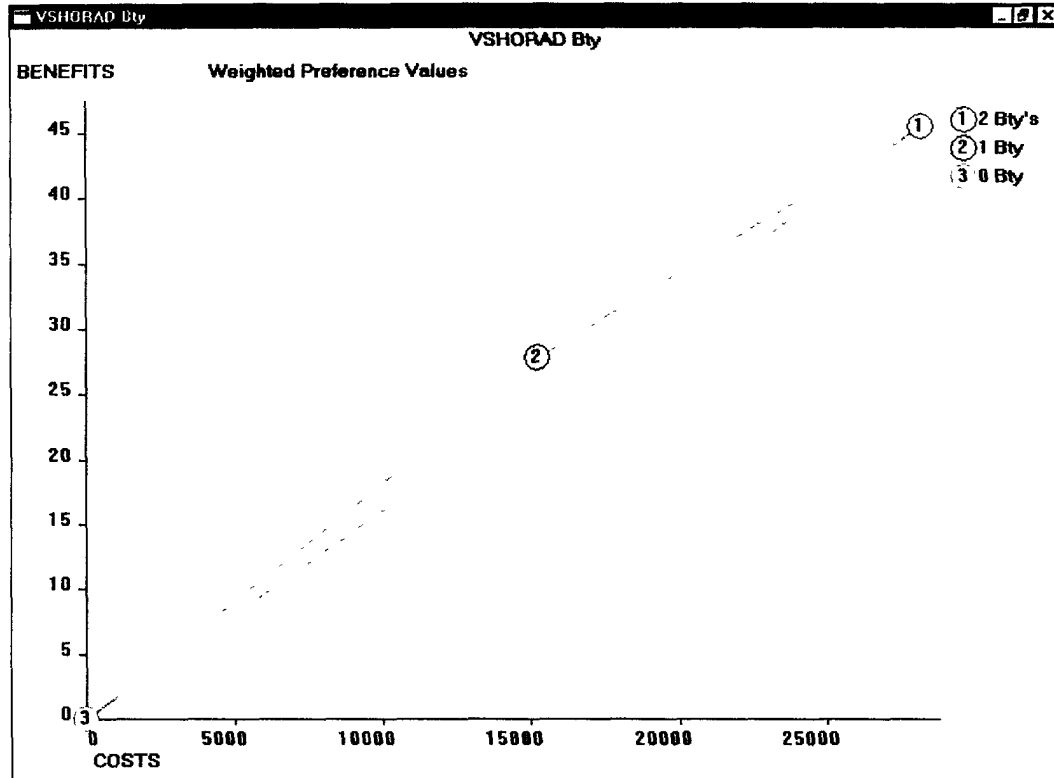


Figure E-12 – Valuation data for a Regular Force Very Short Range Air Defence Battery.

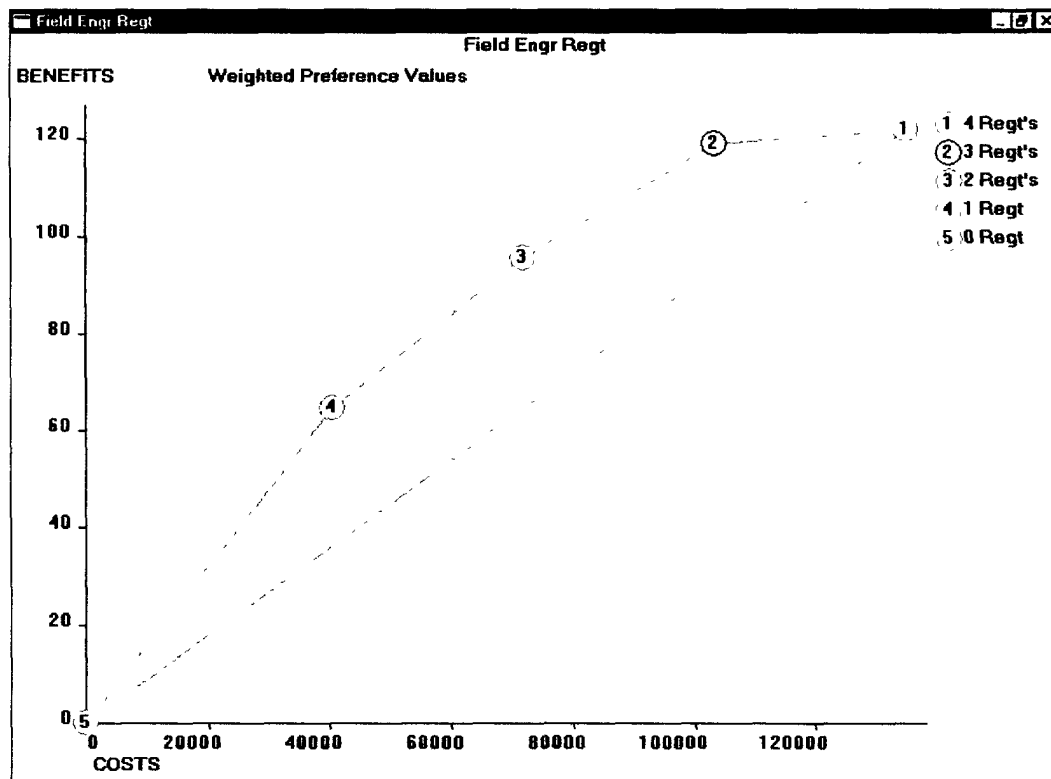


Figure E-13 – Valuation data for a Regular Force Field Engineer Regiment.

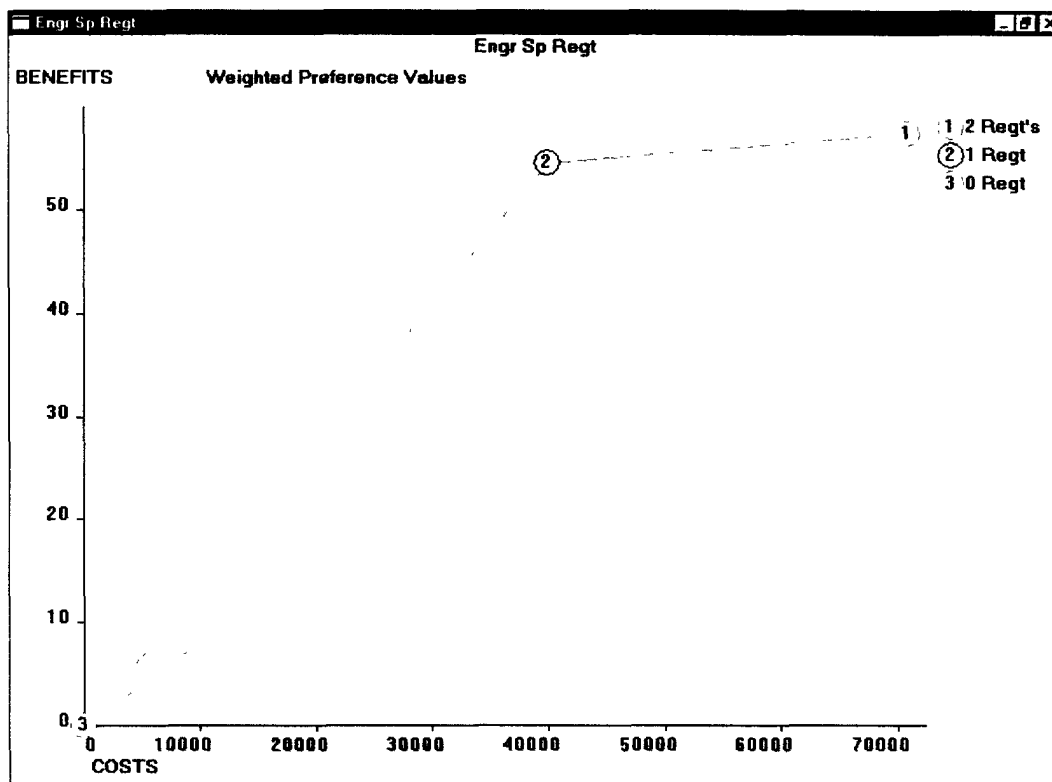


Figure E-14 – Valuation data for a Regular Force Engineer Support Regiment.

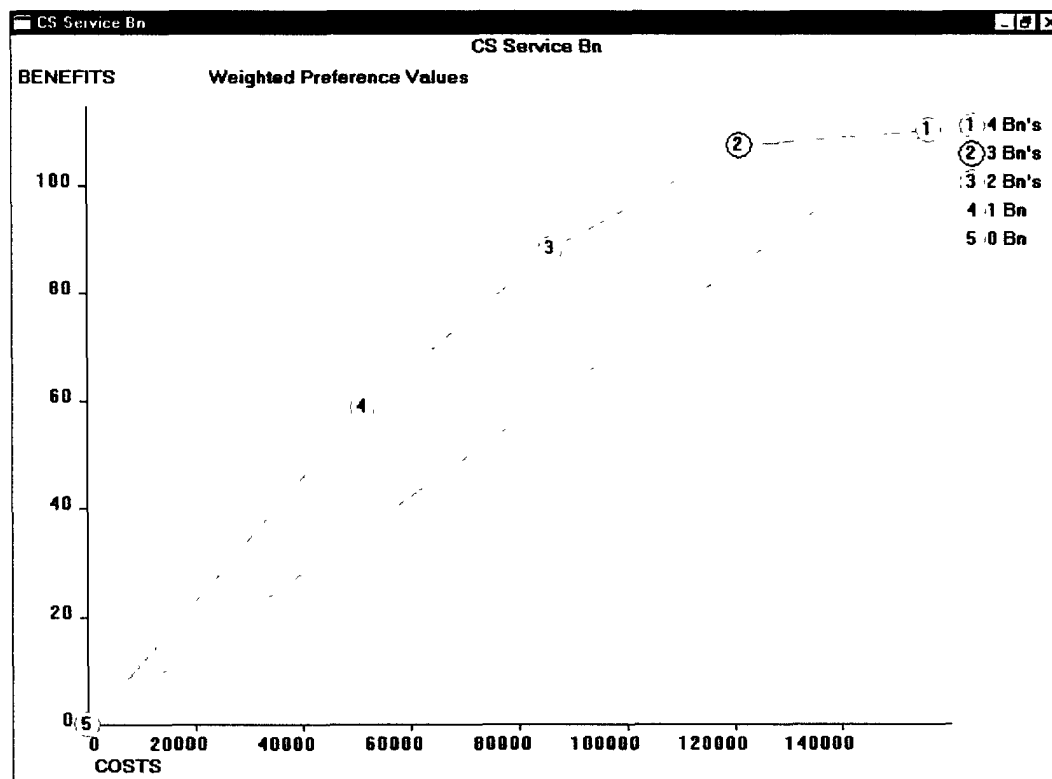


Figure E-15 – Valuation data for a Regular Force Close Support Service Battalion.

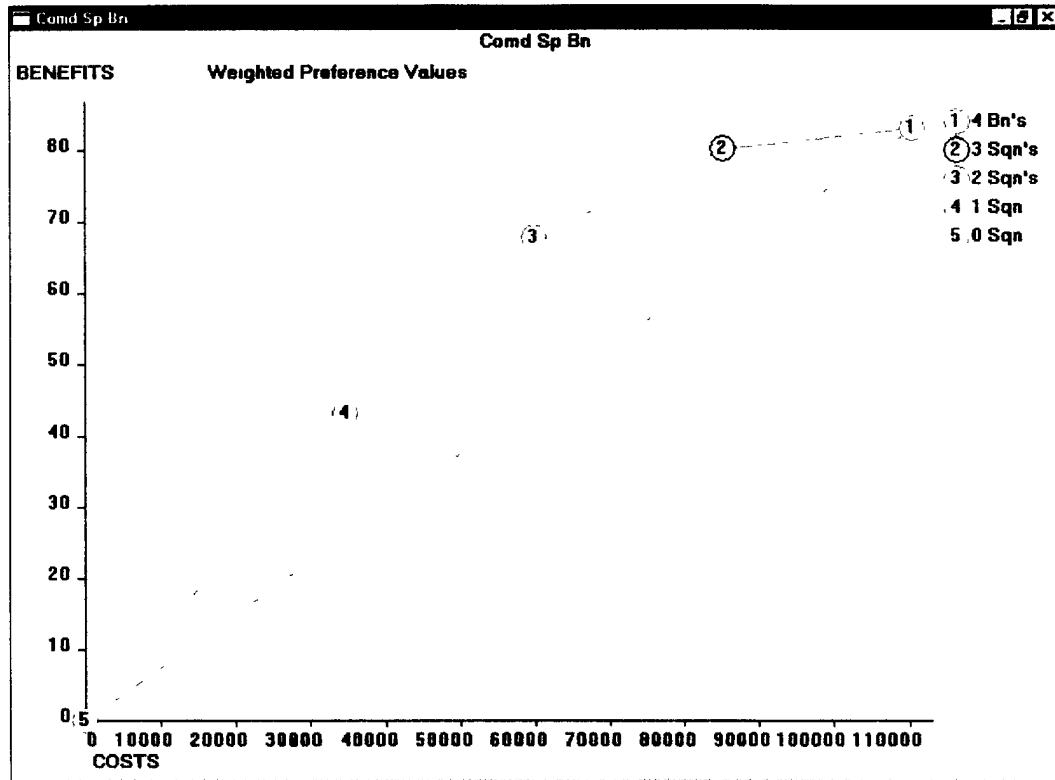


Figure E-16 – Valuation data for a Regular Force Command Support Battalion.

## RESERVE FORCE DATA

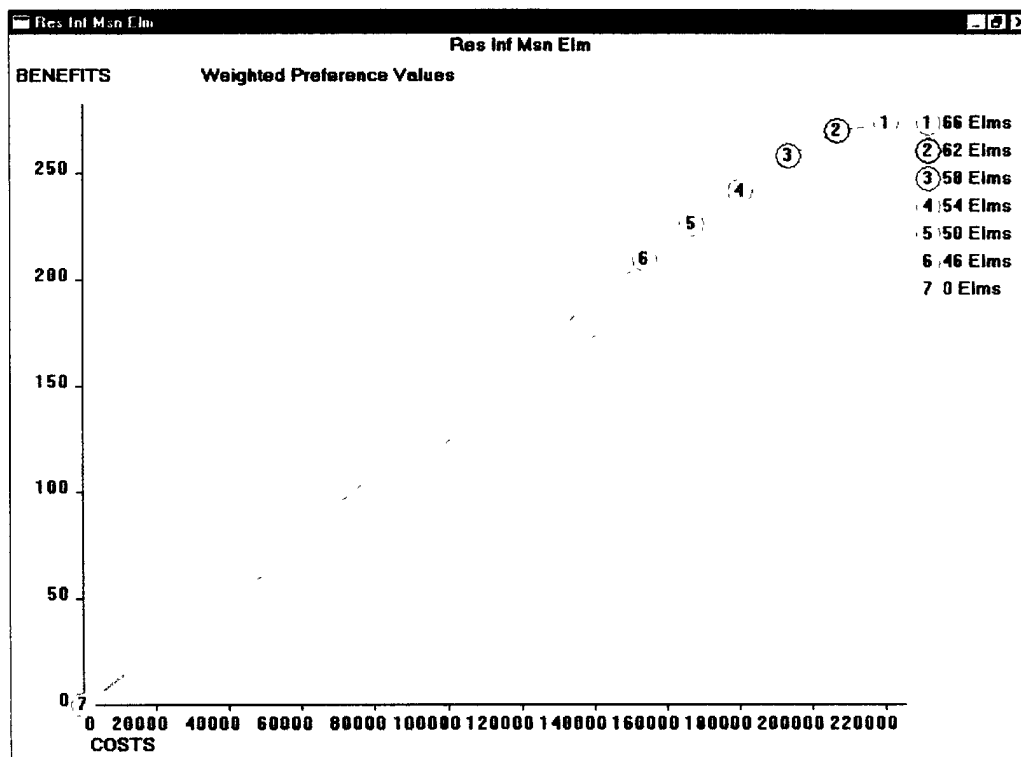


Figure E-17 – Valuation data for a Reserve Force Infantry Mission Element.

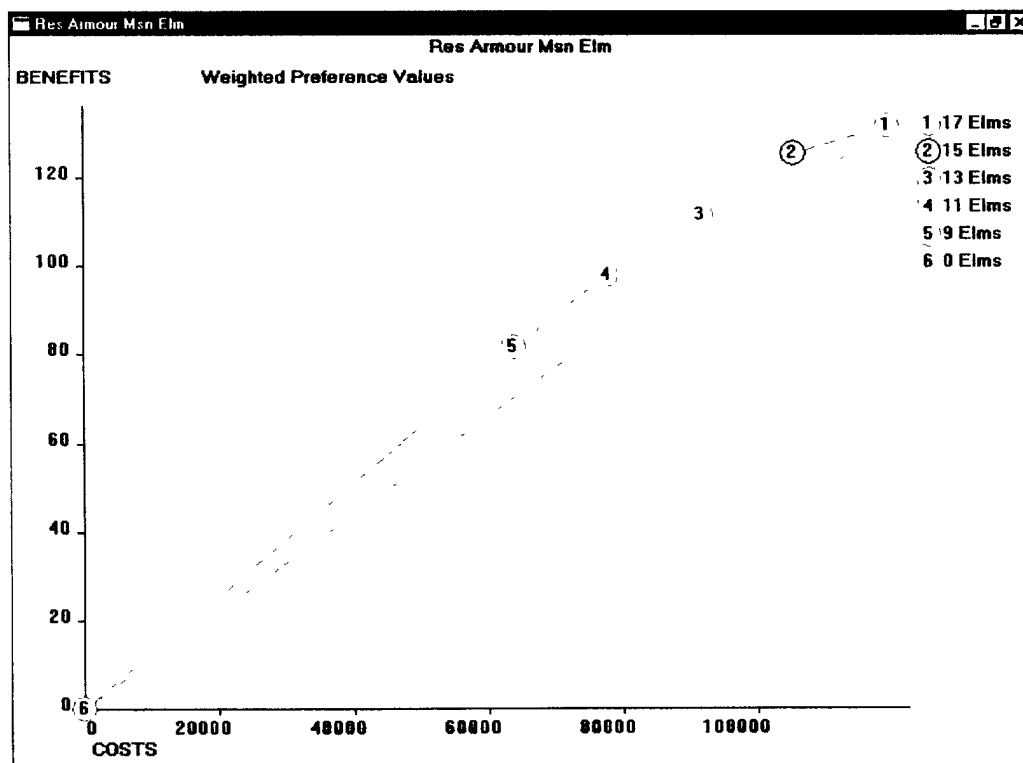


Figure E-18 – Valuation data for a Reserve Force Armoured Mission Element.

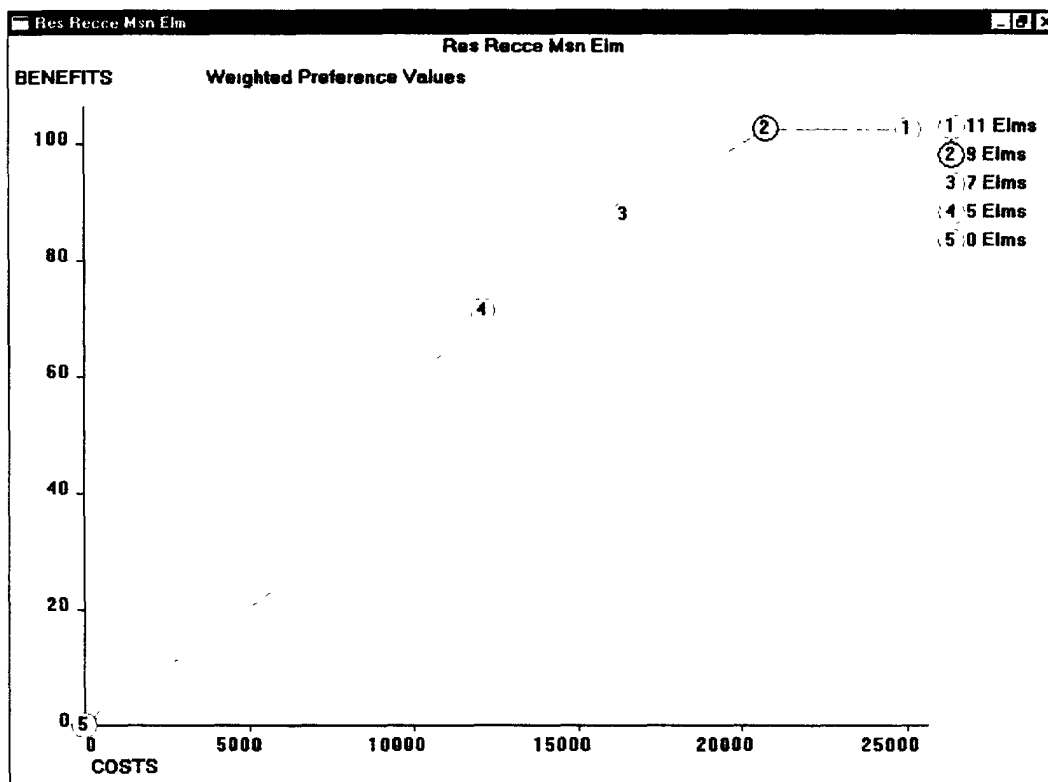


Figure E-19 – Valuation data for a Reserve Force Reconnaissance Mission Element.

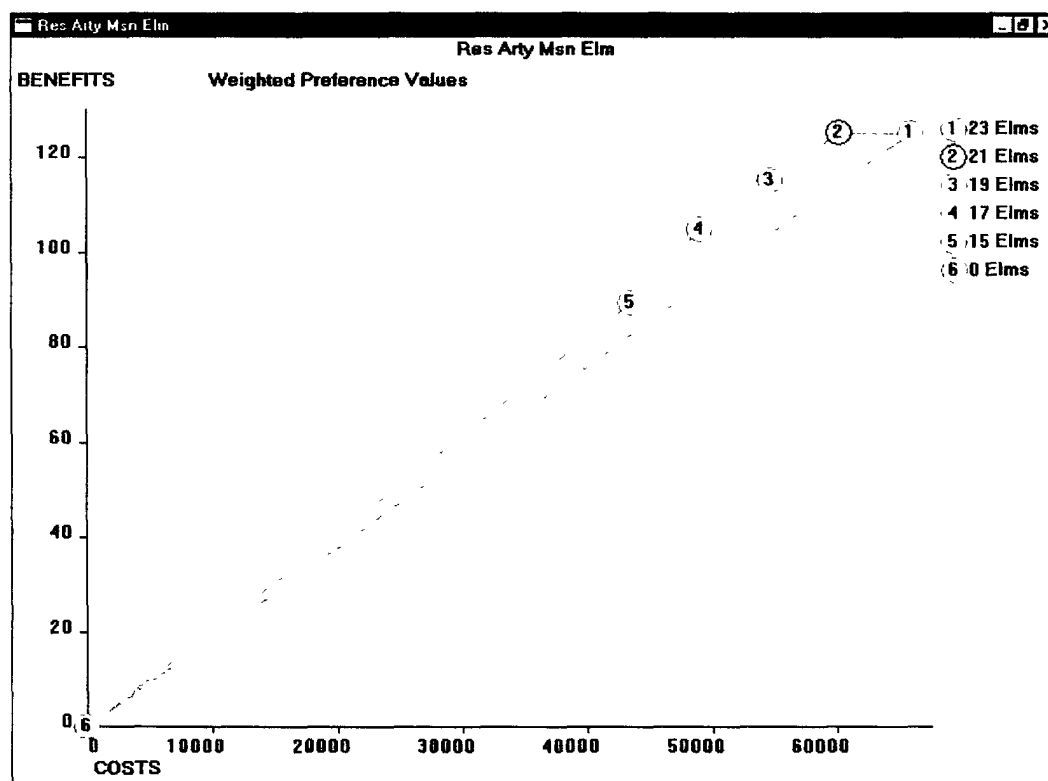


Figure E-20 – Valuation data for a Reserve Force Artillery Mission Element.

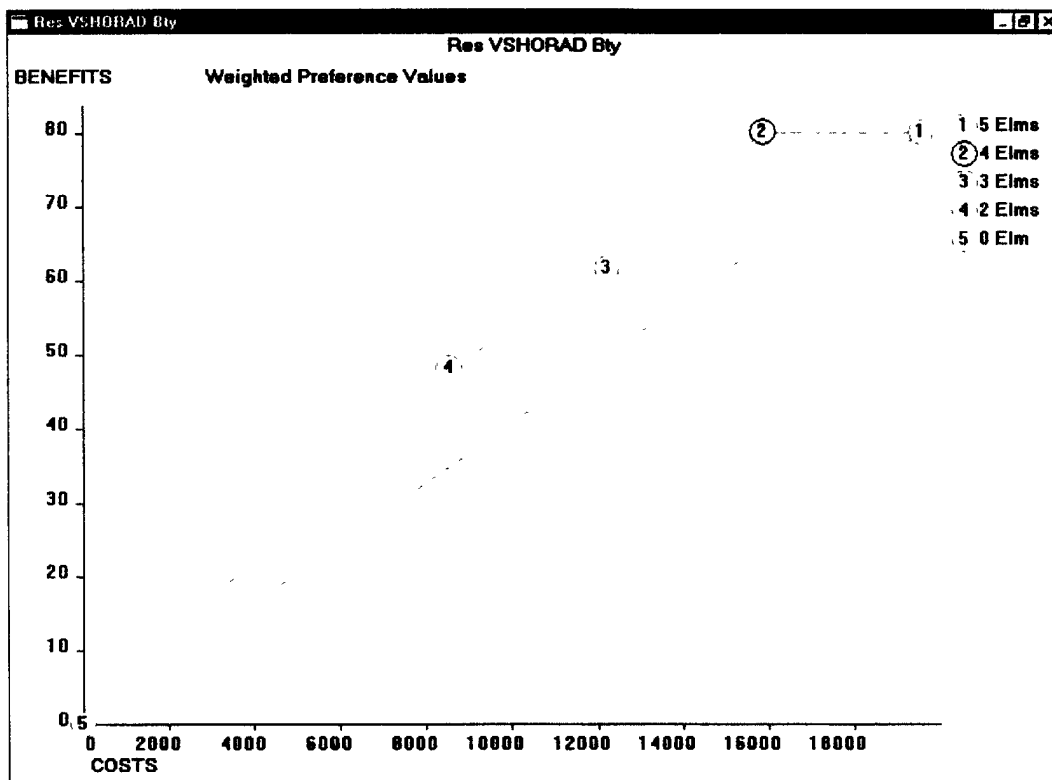


Figure E-21 – Valuation data for a Reserve Force Very Short Range Air Defence Battery.

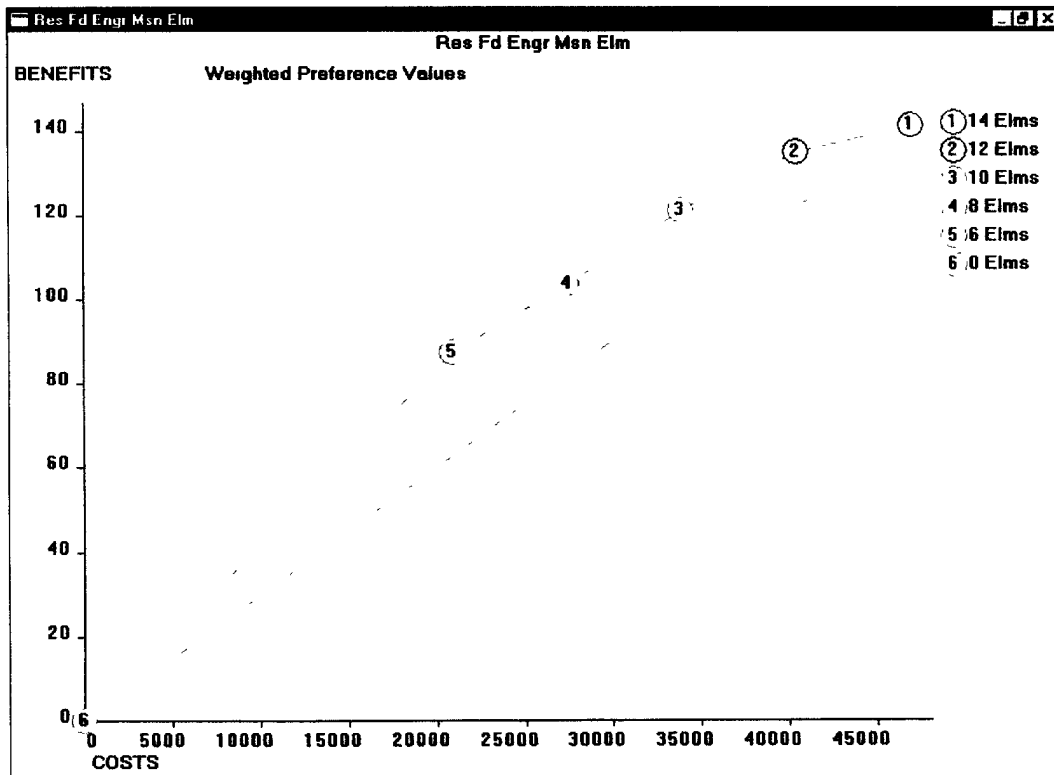
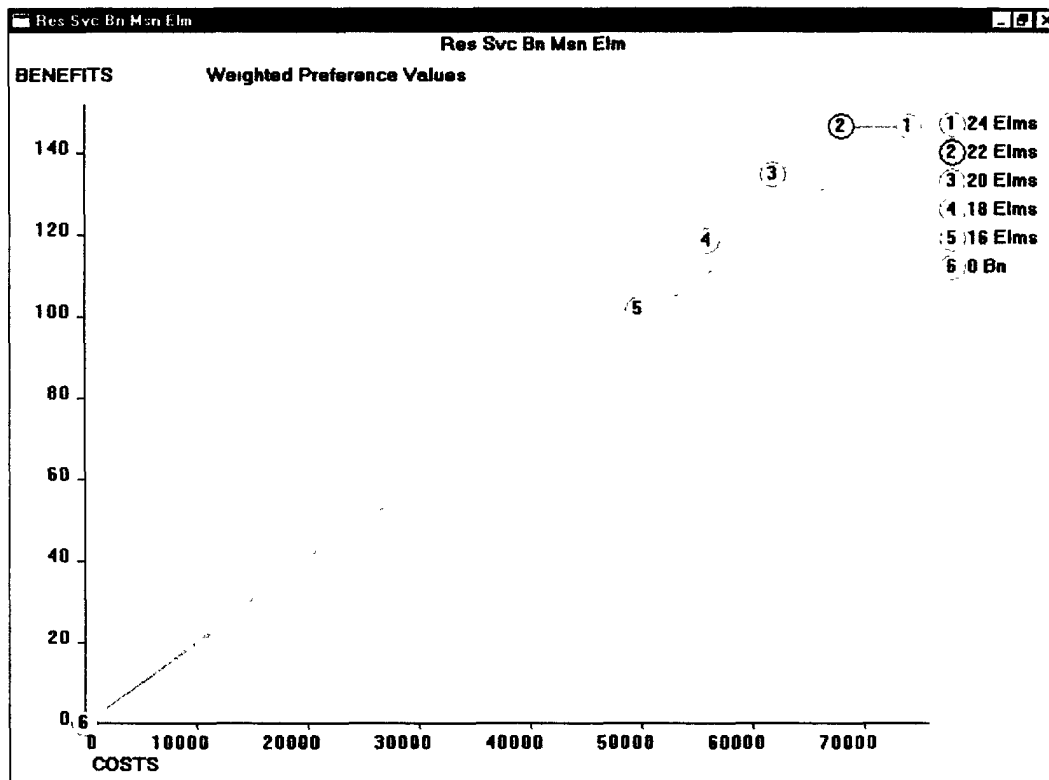


Figure E-22 – Valuation data for a Reserve Force Field Engineer Mission Element.



**Figure 23 – Valuation data for a Reserve Force Service Battalion Mission Element.**

ANNEX F  
ORD PROJECT REPORT PR 2001/21  
NOVEMBER 2001

### **Syndicate Presentations**

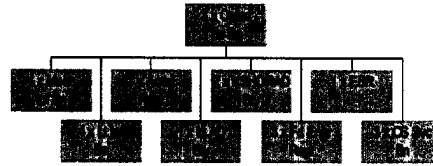
Each of the five Syndicates at the Army Sustainability Exercise (ASX) was tasked to evaluate one of the “cost-effective” force structures that EQUITY provided based on the ASX participants’ valuations, and to modify them so that they were viable Army force structures. The results of those efforts were presented to the Chief of the Land Staff at the ASX. Those presentations are included as Appendices 1 through 5.

APPENDIX 1  
ANNEX F  
ORD PROJECT REPORT PR 2001/21  
NOVEMBER

AFFORDABLE ARMY  
STRUCTURE OPTIONS

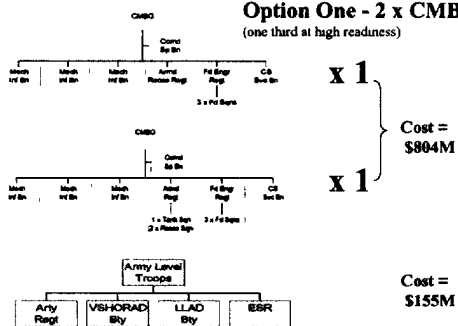
Syndicate 1 Presentation  
6 April 01

Equity Model



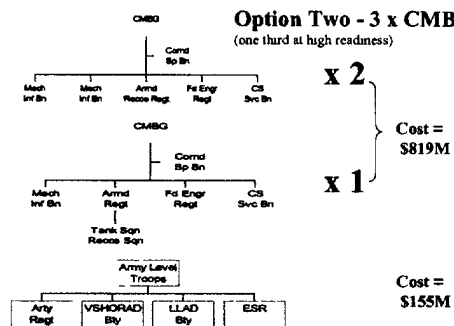
Total Cost = \$964M

Option One - 2 x CMBG  
(one third at high readiness)



Option One TOTAL COST = \$959M

Option Two - 3 x CMBG  
(one third at high readiness)



Option Two TOTAL COST = \$974M

Conclusion

- Costing
  - Equity Model Cost - \$964M
  - Option One (2 x CMBGs) - \$959M
  - Option Two (3 x CMBGs) - \$974M
- All options are basically affordable
- All options meet scenario force reqrs.
- Option 1 can only sustain 1 x BG and 1 other task (once in and out) which does comply with slight modification to DPG tasks. With only 2 Comd Sp Bns it must rely upon CF JOG for every 3rd ATOF roto. Option 2 does not comply as well to DPG tasks but is less problematic WRT ATOF.
- Unsustained tk capability exists in both options. Longer rge dir fir capability must be reviewed in light of this risk. Tk trg capability could be built into CMTC and CTC (possible Res role).
- Approx 3000 soldiers reduced with resultant op tempo issues to be considered.
- Army level troops cannot be suby to ATOF reqrs.
- Option 1 is recommended

Increasing the Value of the Reserves

- Augmentation
  - better integrate eqpt/trg to meet sustainment reqrs
  - Res should have a greater role in assisting to meet ATOF tp reqrs. Integrate tk role into res with focus on CMTC trg. Cougars could be tk trainers
  - specialized roles would help. Ex. CIMIC, PSYOPS
  - reduce perception of backfill vice emphasis on the augmentation role
- Footprint
  - visibility. PR and exposure of the Ca Public to the Army
  - could utilize link to community in a broader sense through involvement in Ca Business
- Mobilization
  - MCF roles particularly important from sustainment perspective
- Counter-point View
  - simplify training and structure to gain greater value relative to cost by focusing upon basic soldiery. Cycle through many more soldiers with less emphasis on retention and greater on flow-through

APPENDIX 2  
ANNEX F  
ORD PROJECT REPORT PR 2001/21  
NOVEMBER

ASX PRESENTATION

2 Syndicate "Mid Point Option"

SCOPE

- 2 Brigade Structure
- 3 Brigade Structure
- Reserve Value Enhancement

6 Apr 01

The Mid-Point

<u>UNITS</u>	<u>Mid-Point</u>
Mech Inf Bn	4
Light Inf Bn	4
Armd Regt	2
Arty Regt	1
LLAD Bty	1
VSHORAD Bty	1
FD Engr Regt	3
Engr Sp Regt	1
CS Svc Bn	3
Comd Sp Bn	2

2 BRIGADE OPTION

<u>UNITS</u>	<u>Mid-Point</u>	<u>2 Bde Option</u>
Mech Inf Bn	4	6
Light Inf Bn	4	0
Armd Regt	2	2
Arty Regt	1	2
LLAD Bty	1	2
VSHORAD Bty	1	2
FD Engr Regt	3	2
Engr Sp Regt	1	0
CS Svc Bn	3	2
Comd Sp Bn	2	2

2 BRIGADE OPTION - NOTES

**HR @ 100%** - 3 x Inf Bn, 1 x Armd Regt, 1 x Field Engr Regt, 1 x VSHORAD Bty, 1 CS Svc Bn

**SR @ 80%** - All others

All Inf Bns are LAV III equipped

The Armd Regts each consist of 2 x Tank Sqns and 2 x Recce Sqns

The Field Engr Regts each consist of 3 x Field Sqns and one Engr Sp Sqn

3 BRIGADE OPTION

<u>UNITS</u>	<u>Mid-Point</u>	<u>3 Bde Option</u>
Mech Inf Bn	4	} 8 (each 75% Mech)
Light Inf Bn	4	
Armd Regt	2	3 (60/40)
Arty Regt	1	3 (40/60)
LLAD Bty	1	0
VSHORAD Bty	1	1
FD Engr Regt	3	3
Engr Sp Regt	1	1
CS Svc Bn	3	3
Comd Sp Bn	2	3

3 BRIGADE OPTION - NOTES

**HR & 100%** 3 x Inf Bn, 1 x Fd Engr Regt, 1 x CS Bn, 1 x Recce Sqn (Deploying units still need 20% Res augmentation)

**SR & 80%** All others (except Armd & Arty)

**All 8 Inf Bn** 2 x Coy (LAV) & 1 x Coy without

**60/40 Armd Regt** RHQ - 1 x Tank & 1 x Recce Sqn (Reg)  
1 x Recce Sqn (Res)

**40/60 Arty Regt** RHQ - 1 x Bty (Reg)  
2 x Bty (Res)

**LLAD** - none

**Note** 2 unallocated LAV III Coy Suite (20 M\$) purchased from "parked capabilities" for flexibility

RESERVE VALUE ENHANCEMENT

1. Fulfill unique/scarcce roles
2. Enhance Reg Force units
  - eg additional coy/tp
  - Assign as Mission to Res unit
  - Same maj equipment type (Reg/Res)
3. Determine Stage 3 and 4 Mobilization upper limits by unit type
4. Increase trg/experience levels (linked to point 2 above)

SUMMARY

<u>UNITS</u>	<u>Mid-Point</u>	<u>2 Bde</u>	<u>3 Bde</u>
Mech Inf Bn	4	6	8 (each 75% Mech)
Light Inf Bn	4	0	
Armd Regt	2	2	3 (60/40)
Arty Regt	1	2	3 (40/60)
LLAD Bty	1	2	0
VSHORAD Bty	1	2	1
FD Engr Regt	3	2	3
Engr Sp Regt	1	0	1
CS Svc Bn	3	2	3
Comd Sp Bn	2	2	3

APPENDIX 3  
ANNEX F  
ORD PROJECT REPORT PR 2001/21  
NOVEMBER

## An Army Force Structure

Based on the EQUITY "C" Point

ASX Syndicate 3

## TASK

- Review model C force structure and recommend improvements at same costs
- Determine implications of our recommended force option on Reserve force
- Build additional Reserve value

## MODEL 'C'

Units	Present	Model C
Mech Inf Bn	6	4
Lt Inf Bn	3	4
Armd	3	3
Arty	3	2
LLAD Bty	1	1
VSHORAD Bty	1	2
CFK	3	3
ESR	1	1
CS Svc Bn	3	3
Comd Sp Bn	3	3

## OBSERVATIONS/COMMENTS

- Critical Imbalance of Mech vs Lt Inf
- Addressing Armd Regt structure
- Extra VSHORAD Battery not reqd
- Recognize/Protect Engr & CSS

Units	C	Balanced	HR/SR
Mech Inf Bn	4	6	2/4
Lt Inf Bn	4	2	1/1
Armd	3	2	1/1
Arty	2	2	1/1
LLAD Bty	1	1	0/1
VSHORAD Bty	2	1	0/1
CER	3	3	1/2
ESR	1	1	0/1
CS Svc Bn	3	3	1/2
Comd Sp Bn	3	3	1/2

## Implications on Reserve Force

- Reduced Regular force capabilities
  - Inf
  - Arty
  - Armd
- Scope for Reserves to restore lost capability

## Building Additional Reserve Value

- Reinforce success (Int Coy & CIMIC)
- Re-group current msn elements into more "viable" units
- New msn/role: Lt Inf, Arty, Lt Recce, GS Engr
- 4th Inf Coy to Reg Bns

APPENDIX 4  
ANNEX F  
ORD PROJECT REPORT PR 2001/21  
NOVEMBER 2001

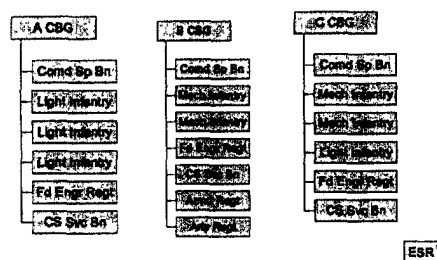
### Syndicate 4

"The Affordable Army"

### Best Military Judgement

- |                        |  |
|------------------------|--|
| • <b>Add</b>           | • <b>Subtract</b>  |
| • 1 Arty Regt (\$62 M) | • LLAD (\$33 M)  |
| • 1 Armd Sqn (\$10M)   | • VSHORAD (\$18 M)   |
|                        | • VSHORAD (\$18 M)   |
|                        | • Reduce 3 units from high readiness to std readiness (\$9M) |
| • TOTAL (\$72 M)       | • TOTAL (\$ 74 M)  |

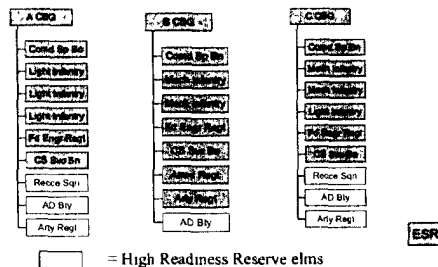
### "Your Army" (like it or not) - Regular Force



### Reserve Restructure - Guiding Concepts

- Estb full strength Reserve units integral to Reg F Bdes providing supplementary capability (clear missions and roles and appr resources)
- Group Res mission elms to reduce C2 overhead - improves resource efficiency
- Maintain specialized capabilities in the Reserve Force (PSYOPs and CIMIC)

### "Your Army" (like it or not) Total Force



### Adjustments to Current Reserve Force (like it or not)

- Infantry ME (62) - Approx 33% decrease
- Arty ME (21) - Approx 50% increase
- Armd ME (15) - Approx 66% decrease
- Recce ME (9) - Status quo
- VSHORAD ME (5)- Approx 300% increase
- Fd Engr ME (12) - Approx 25% increase
- Svc Bn ME (22) - Approx 33% decrease

APPENDIX 5  
ANNEX F  
ORD PROJECT REPORT PR 2001/21  
NOVEMBER 2001

### Syndicate 5

Optimizing about Point M, \$150M  
less than current structure

### Two Options broadly considered

- 3 Bde structure
- 2 Bde structure

Both supporting ATOF  
Essential cbt capability retained  
Op tempo supported  
Not all units high readiness

### Army Troops

- Arty Regt
- ESR
- EW

### 2 Bde Option

#### Tradeoffs

3 CERs to 2+  
3 Svc Bn to 2+  
~ \$10M  
No LLAD  
savings \$32M  
Managed readiness  
savings \$26M

#### Benefits

- 2 Mech Coy eqpt avail  
for CMTC
- additional Mech Bn  
eqpt per Bde
- 4 Mech Bns per Bde

### 3 Bde Option

#### Tradeoffs

- No LLAD or  
VSHORAD
- Reduce high  
Readiness to staged  
readiness
- asymmetric bdes mix  
of Lt/Mech,  
Armd/Rece

#### Benefits

- Additional Comd Sp  
Bn
- Additional Lt Bn

### Reserve Integration and Role

- VSHORAD
- mission sub-element within Lt Inf Coy for  
ea Mech Bn
- mission sub-elm assigned for ea of Armd,  
Arty, Engr, CSS
- Hy Tpt for Svc Bn
- MP PI
- Int Coy sub-elm within Comd Sp Bn
- 20% augmentation throughout for missions

ANNEX G  
ORD PROJECT REPORT PR 2001/21  
NOVEMBER 2001

## Guidelines for Valuing Portfolio Elements Against Scenarios

### Guidelines for Valuing Portfolio Elements Against Scenarios

Col W. Peters  
DLSP

### Guidelines for Valuing Portfolio Elements Against Scenarios

- Determine "ideal" force package (TSSU)
- Judge the number of unit equivalents this represents (3 coys/sqns/btys equals unit) - if sustainability (indefinite) is an issue, use  $4+1=5$  to determine total number required
- Plan vertically first, computing a rough unit value out of 100 (5 unit equiv = 20 for each unit, 7 for a sub-unit)
- Score vertically (giving bonus to core units as appr) and fine tune - **Does not have to total exactly 100!**
- Consider and score value of other types of units
- Complete the horizontal scores, highlighting a small number of priorities for additional units by showing marginal utility and "flat line" the rest

Regular Force BG unsustained	Score							
Mechanized Infantry Battalion	57	57	57	57	57	55	50	
Light Infantry Battalion	37	37	35	30				
Armour Regiment	20	20	20	20				
Artillery Regiment	15	15	15	15				
LLAD Battery	10	10						
VSHORAD Battery	0	0						
Field Engineer Regiment	0	0	0	0	0			
Engineer Support Regiment	0	0						
CS Service Battalion	15	15	15	15				
Command Support Battalion	0	0	0	0				

Regular Force MCD Bde	Score							
Mechanized Infantry Battalion	45	45	45	45	40	25	12	
Light Infantry Battalion	10	8	8	4				
Armour Regiment	15	15	15	10				
Artillery Regiment	10	10	10	10				
LLAD Battery	5	5						
VSHORAD Battery	0	0						
Field Engineer Regiment	12	12	12	10				
Engineer Support Regiment	0	0						
CS Service Battalion	13	13	13	10				
Command Support Battalion	10	10	10	10				

Regular Force BG Sustained	Score							
Mechanized Infantry Battalion	80	55	80	25	15	10	7	
Light Infantry Battalion	15	11	7	5				
Armour Regiment	25	23	20	10				
Artillery Regiment	25	23	20	10				
LLAD Battery	15	7						
VSHORAD Battery	0	0						
Field Engineer Regiment	19	17	15	5				
Engineer Support Regiment	0	0						
CS Service Battalion	19	17	15	5				
Command Support Battalion	0	0	0	0				

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(Security classification of title, body of abstract and indexing annotation must be entered when the overall document is classified)		
1 ORIGINATOR (the name and address of the organization preparing the document. Organizations for whom the document was prepared <i>e.g.</i> Establishment Sponsoring a contractor's report, or tasking agency, are entered in Section 8).  <b>Operational Research Division Department of National Defence Ottawa, Ontario K1A 0K2</b>	2 SECURITY CLASSIFICATION (overall security classification of the document, including special warning terms if applicable)  <p style="text-align: center;"><b>UNCLASSIFIED</b></p>	
3 TITLE (the complete document title as indicated on the title page. Its classification should be indicated by the appropriate abbreviation (S, C or U) in parentheses after the title)  <p style="text-align: center;"><b>Operational Research Support to the Army Sustainability Exercise</b></p>		
4 AUTHORS (last name, first name, middle initial)  <p style="text-align: center;"><b>Offiong, Jason, J.; Hales, Douglas; Richards, Barry</b></p>		
5 DATE OF PUBLICATION (month Year of Publication of document)  <p style="text-align: center;"><b>November 2001</b></p>	6a NO OF PAGES (total containing information. Include Annexes, Appendices, <i>etc.</i> )  <p style="text-align: center;"><b>184</b></p>	6b. NO OF REFS (total cited in document)  <p style="text-align: center;"><b>19</b></p>
7. DESCRIPTIVE NOTES (the category of document, <i>e.g.</i> technical report, technical note or memorandum. If appropriate, enter the type of report <i>e.g.</i> interim, progress, summary, annual or final. Give the inclusive dates when a specific reporting period is covered.)  <p style="text-align: center;"><b>Project Report</b></p>		
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**The Army Sustainability Exercise (ASX) was conducted from 2-6 April 2001 in Montebello, Quebec. The aim of the ASX was to produce a blueprint for a sustainable (costs and activity levels) Army by 2004. A cost-benefit analysis was conducted using a software package called EQUITY® to assess the value of Army units against several predetermined criteria. The EQUITY outputs were force structure options for the Regular and Reserve Forces that maximised their value based on the participants' valuations. ASX syndicates then applied the operator knowledge and expertise using these EQUITY "solutions" as starting points to generate proposals for a sustainable Army. The effectiveness of these new force structures in meeting the demands for operational assets generated by the concurrent activation of the Force Planning Scenarios was assessed using the Scenario Operational Capability Risk Assessment Model (SOCRAM)**

14 KEYWORDS, DESCRIPTORS or IDENTIFIERS (technically meaningful terms or short phrases that characterize a document and could be helpful in cataloguing the document. They should be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location may also be included. If possible keywords should be selected from a published thesaurus, e.g. Thesaurus of Engineering and Scientific Terms (TEST) and that thesaurus-identified. If it is not possible to select indexing terms which are Unclassified, the classification of each should be indicated as with the title.)

**Army Force Structure**

**Army Restructuring**

**Army Sustainability Exercise**

**ASX**

**Cost-Benefit Analysis**

**EQUITY**

**Force Structure Planning**

**Land Force**

**Scenario Operational Capability Risk Assessment Model**

**SOCRAM**

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